Cardio Menu
Service Manual

Welch Allyn™
Schiller®

AT-5

6-Channel Electrocardiograph

User's Guide

AT-5

6-Channel Electrocardiograph

User`s Guide

Article Number 2. 510 275
January 1998

Associated Documents

Physician`s Guide to the Interpretation and Measurement Program
Article Number 2. 510 179

Welch Allyn™
Schiller®

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DECLARATION OF CONFORMITY

Electrocardiograph:	**AT-5**
Serial numbers starting with:	181.
Year of manufacture:	1995 Onwards

We, the undersigned, hereby declare that the medical device (class IIa) specified above conforms with the essential requirement listed in Annex 1 of EC Directive 93/42/EEC.

This declaration is supported by:

Certificate of approval No:	11425-01	ISO 9001 (Rev.1994) EN 46001 by SQS
	45112-60-00	ISO 9001/08.94, EN 46001 / 12.93 by DEKRA
and	45112-16-00 (30.04.1995)	Annex II, Section 3 of the Directive 93/42/EEC

CE 0124

Baar (Switzerland) 09.12.1996

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Terms of Warranty

WELCH ALLYN SCHILLER warrants the AT-5 Electrocardiograph, when new, to be free of defects in material and workmanship and to perform in accordance with manufacturer's specifications for the period of three (3) years from the date of purchase from Welch Allyn or it's authorized distributors or agents. Accessory items such as electrodes, batteries and cables are limited to a warranty of 90 days from the date of purchase from Welch Allyn or its authorized distributors or agents. Welch Allyn will repair or replace any components found to be defective or at variance from manufacturer's specifications within this time at no cost to the customer. It shall be the purchasers responsibility to return the instrument to Welch Allyn or an authorized distributer, agent or service representative. This warranty does not include breakage or failure due to tampering, misuse, neglect, accidents, modifications or shipping. This warranty is also void if the instrument is not used in accordance with manufacturer's recommendations or if repaired by other than Welch Allyn or an authorized agent. Purchase date determines warranty requirements. No other express warranty is given.

PHYSICIAN'S RESPONSIBILITY

THE AT-5 ELECTROCARDIOGRAPH IS PROVIDED FOR THE EXCLUSIVE USE OF QUALIFIED PHYSICIANS OR PERSONNEL UNDER THEIR DIRECT SUPERVISION. THE NUMERICAL AND GRAPHICAL RESULTS FROM A RECORDING MUST BE EXAMINED WITH RESPECT TO THE PATIENTS OVERALL CLINICAL CONDITION. THE RECORDING PREPARATION QUALITY AND THE GENERAL RECORDED DATA QUALITY, WHICH COULD EFFECT THE REPORT DATA ACCURACY, MUST ALSO BE TAKEN INTO ACCOUNT.

IT IS THE PHYSICIANS RESPONSIBILITY TO MAKE THE DIAGNOSIS OR TO OBTAIN EXPERT OPINION ON THE RESULTS, AND TO INSTITUTE CORRECT TREATMENT IF INDICATED.

FEDERAL LAW IN THE USA RESTRICTS THIS DEVICE TO SALE BY OR ON THE ORDER OF A PHYSICIAN

Safety Notices

TO PREVENT ELECTRIC SHOCK DO NOT DISASSEMBLE THE UNIT. NO SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL ONLY.

DO NOT USE THIS UNIT IN AREAS WHERE THERE IS ANY DANGER OF EXPLOSION OR THE PRESENCE OF FLAMMABLE GASES SUCH AS ANAESTHETIC AGENTS.

THIS PRODUCT IS NOT DESIGNED FOR STERILE USE.

THIS PRODUCT IS NOT DESIGNED FOR OUTDOOR USE.

SWITCH THE UNIT OFF BEFORE CLEANING AND DISCONNECT FROM THE MAINS.

DO NOT, UNDER ANY CIRCUMSTANCES, IMMERSE THE UNIT OR CABLE ASSEMBLIES IN LIQUID.

THE DEVICE MUST ONLY BE OPERATED USING BATTERY POWER IF THE EARTH CONNECTION IS SUSPECT OR IF THE MAINS LEAD IS DAMAGED OR SUSPECTED OF BEING DAMAGED.

DO NOT USE HIGH TEMPERATURE STERILISATION PROCESSES (SUCH AS AUTOCLAVING). DO NOT USE E-BEAM OR GAMMA RADIATION STERILISATION.

DO NOT USE SOLVENT CLEANERS

USE ONLY ACCESSORIES AND OTHER PARTS RECOMMENDED OR SUPPLIED BY WELCH ALLYN SCHILLER. USE OF OTHER THAN RECOMMENDED OR SUPPLIED PARTS MAY RESULT IN INJURY INACCURATE INFORMATION AND/ OR DAMAGE TO THE UNIT.

THE AT-5 COMPLIES WITH EMC REGULATIONS FOR MEDICAL PRODUCTS WHICH AFFORDS PROTECTION AGAINST EMISSIONS AND ELECTRICAL INTERFERENCE. HOWEVER SPECIAL CARE MUST BE EXERCISED WHEN THE UNIT IS USED WITH HIGH FREQUENCY EQUIPMENT.

IT MUST BE ENSURED THAT NEITHER THE PATIENT NOR THE ELECTRODES (INCLUDING THE NEUTRAL ELECTRODE) COME INTO CONTACT WITH OTHER PERSONS OR CONDUCTING OBJECTS (EVEN IF THESE ARE EARTHED).

THERE IS NO DANGER WHEN USING THE ECG UNIT FOR A ***PACEMAKER PATIENT*** *OR WITH SIMULTANEOUS USE OF OTHER ELECTRICAL STIMULATION EQUIPMENT. HOWEVER, THE STIMULATION UNITS SHOULD ONLY BE USED AT A SUFFICIENT DISTANCE FROM THE ELECTRODES. IN CASE OF DOUBT, THE PATIENT SHOULD BE DISCONNECTED FROM THE RECORDER.*

THIS UNIT IS CF CLASSIFIED ACCORDING TO IEC 601-1. THIS MEANS THAT THE PATIENT CONNECTION IS FULLY ISOLATED AND DEFIBRILLATION PROTECTED. WELCH ALLYN SCHILLER CAN ONLY GUARANTEE PROTECTION AGAINST DEFIBRILLATION VOLTAGE HOWEVER, WHEN THE ORIGINAL WELCH ALLYN SCHILLER PATIENT CABLE IS USED.

IF SEVERAL UNITS ARE COUPLED THERE IS A DANGER OF SUMMATION OF LEAKAGE CURRENT

DO NOT TOUCH THE CASING DURING DEFIBRILLATION

IF THE PATIENT CABLE SHOULD BECOME DEFECTIVE AFTER DEFIBRILLATION, LEAD OFF WILL BE DISPLAYED AND AN ACOUSTIC ALARM GIVEN

AT-5 User`s Guide

This User`s Guide gives instructions on how to operate the unit and provides an overview of all the basic functions in an easy and simple to use format. The procedures are presented in a logical, step-by step way to enable the user to quickly and easily familiarise themselves with unit operation. Detailed medical information is excluded from this guide except where necessary to operate the unit or understand the results.

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CE 0124 93/42/EEC Medical Devices:
0124 `Notified Body` DEKRA AG

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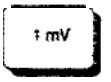

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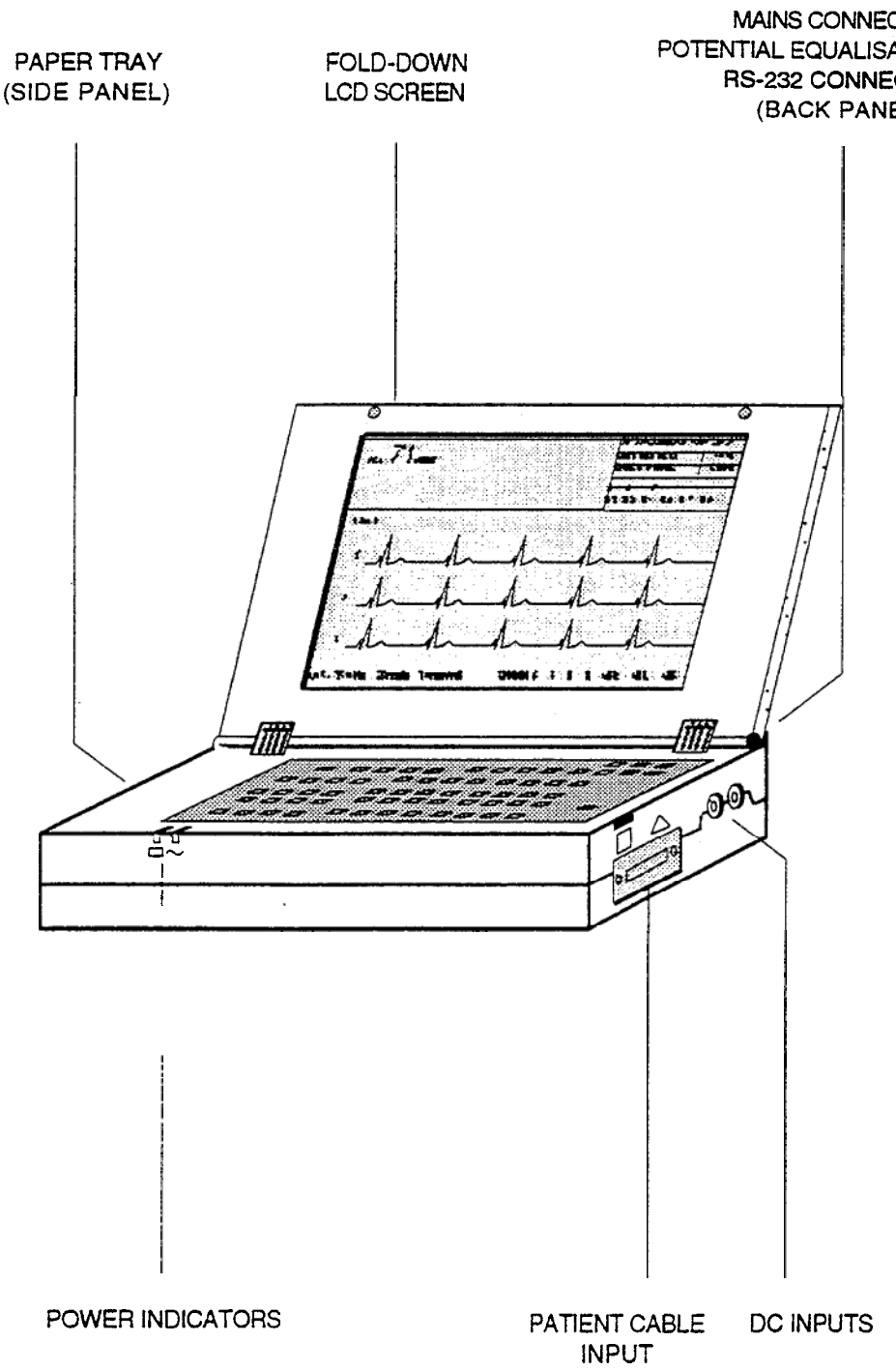


THE SCHILLER SCHILLER AT-5

CHAPTER 1

GETTING STARTED

The SCHILLER AT-5 is a technologically advanced, compact, sophisticated but easy to use electrocardiograph. It has the following features:

- **Low weight and compact dimensions for portability.**
- **Battery Backup for mains independent operation.**
- **Large, clear and bright LCD display for the simultaneous monitoring of up to 8 leads.**
- **Simple Menu guidance for ease of operation.**
- **Programmable function keys (MACRO) to execute often used test procedures.**
- **High quality integrated thermal printer combined with several print functions and formats to ensure clear and precise documentation of important information.**
- **Automatic paper tray extend and retract.**
- **DC input connections for on-screen presentation or printout.**
- **RS-232 interface for data transmission/reception to another unit or a PC (for example transmission to the SCHILLER data management program SEMA for the verification and archiving of recorded data).**
- **Built-in memory to store recorded ECGs.**
- **Optional Interpretation and Measurement Programs for accurate analysis of results.**

LOCATION

- Do not keep or operate the unit in a wet, moist, or dusty environment. Avoid exposure to direct sunlight or heat from other sources.
- Do not allow the unit to come into contact with acidic vapours or liquids.
- The unit should not be placed in the vicinity of X-ray or diathermy units, large transformers or electric motors. It must also be positioned at least one meter from the mains supply.

Potential Equalisation

The potential equalization connector (provided at the rear of the unit) is marked with the symbol above. The yellow/green ground lead supplied as an option fits to the connector.

Using this connector the ECG unit may be linked to the potential equalization connector of other mains powered equipment to ensure that all instruments are at the same earth potential.

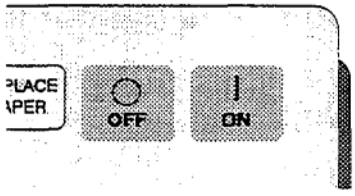
GETTING TO KNOW YOUR AT-5

Switching On/Off

Connect the power cable between the mains supply and the mains connector on the rear of the unit. The green mains indicator ~ shows that mains is connected.

§ *The AT-5 can remain connected to the mains supply indefinitely without damage.*

The unit is switched on and off with the ON and OFF keys on the keyboard.



Power Supply

The built-in battery is automatically charged when mains is connected to the unit. A fully discharged battery takes approximately 1.5 hours to charge.

The green mains indicator lamp at the front of the casing is illuminated when mains is connected. When operating on battery power, the yellow battery indicator is illuminated.

The yellow battery indicator also gives warning that the battery has limited capacity. When the battery has discharged to approximately 20% of full capacity, the yellow indicator blinks.

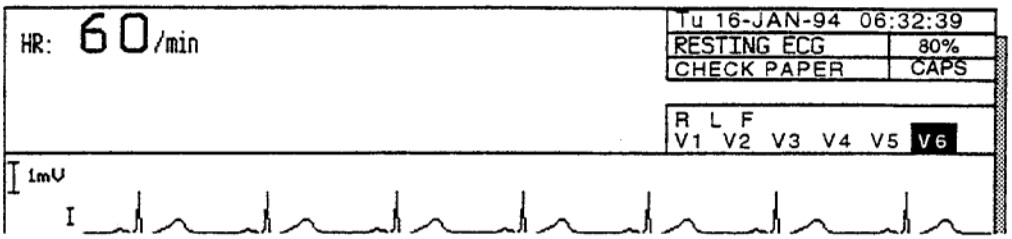
Connect the unit to the mains supply to recharge the battery. The green mains indicator is lit and the battery indicator lights during charging until the battery is completely recharged. When the battery is almost fully charged a 'top-off' charge is activated; during this phase the battery indicator may light for a few seconds every half minute.

Both the battery and the mains indicators are visible when the screen is folded down. The battery capacity is additionally shown on the right-hand side of the screen as a percentage of full capacity.

The SCHILLER AT-5 can remain connected to the mains supply without danger to either the unit or the battery.

Liquid Crystal Display (LCD)

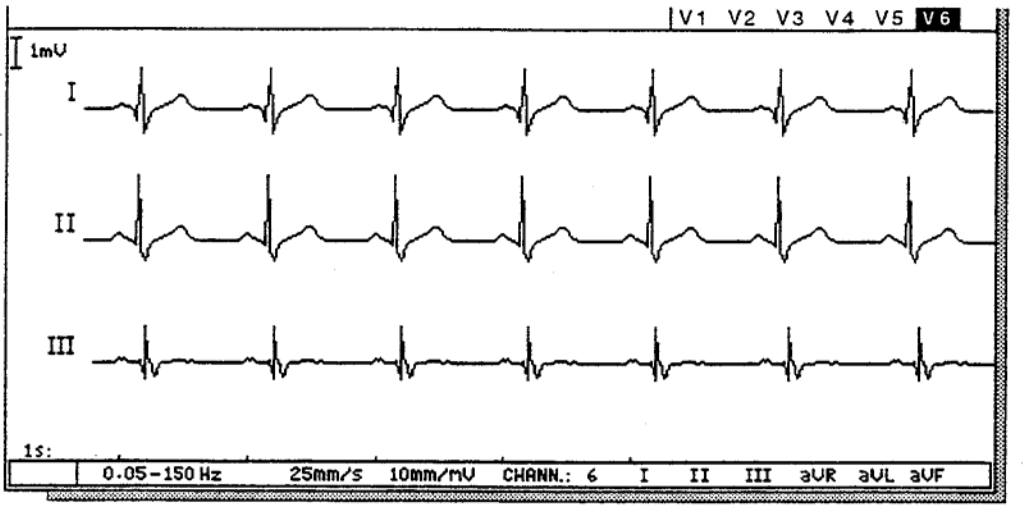
The liquid crystal display (LCD) performs both as a real-time monitor and as an alphanumeric display for menu selection, data input and for the display of important system information.



Status and operating information are permanently displayed in the top section of the screen. The left side displays the heart rate (HR) and the right side is divided into the following fields:

- Date and Time.
- Information field - This details the test being performed.
- Message field - This displays any status or error messages applicable etc.
- Remaining Battery capacity as a % of full battery capacity.
  - *The operation time available from a fully charged battery (capacity indication 100%) varies with use. The AT-5 will run for approximately an hour without printing. This time is reduced significantly when the printer is activated.*
- Status of the capital letter lock. "CAPS" indicates capital letter lock on and indicates that all entries via the keyboard will be in capital letters. No indication is given here when normal upper/lower case letters are selected. The ⇧ key toggles between upper case and lower case.
- Lead status of the right arm, left arm, foot and V1 to V6 (electrodes C1 to C6).
  - *If a lead-off is detected at any time on any of the electrode connections, an audible alarm is given and the electrode that is high resistance flashes. When this happens reapply the electrode. In the display above electrode C6 (lead V6) is disconnected.*

    In exceptional circumstances if the indicator continues to flash after the electrode has been reapplied, it can indicate a problem with the patient cable. Use the cable tester (detailed later in this chapter) to check.



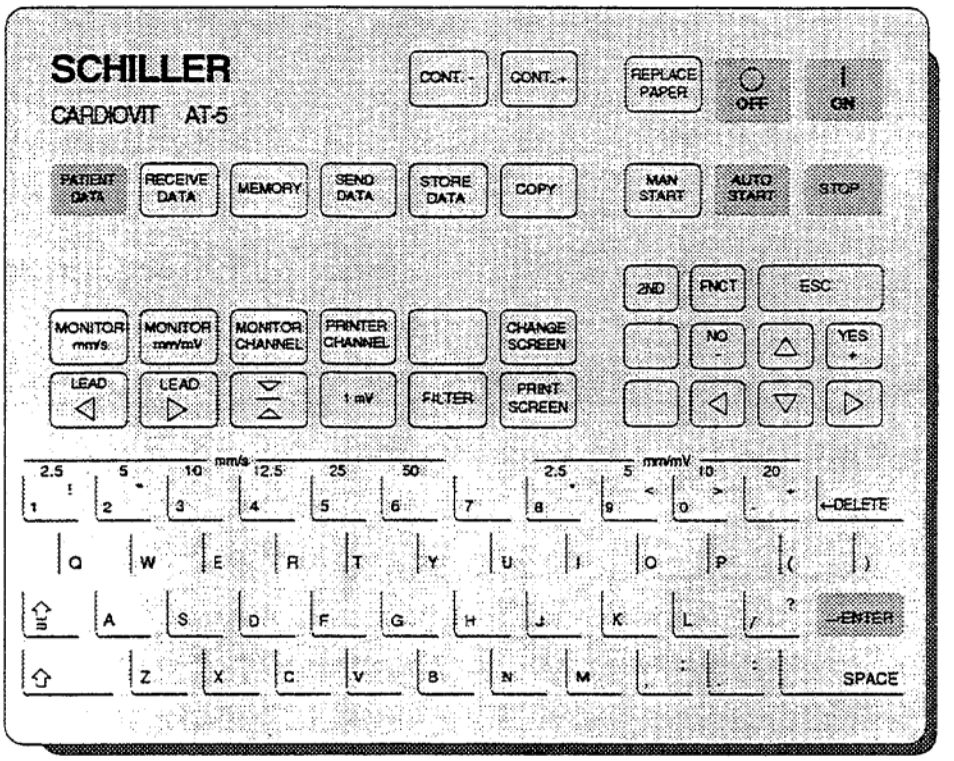
The central section of the screen is taken up with the measured waveform (i.e. ECG trace). The lead identifications or measurement units are given on the left-hand side. In the left hand corner is the 1 mV reference.

The bottom line of the LCD gives, from left to right.

- The selected Baseline and Myogram filter settings. This value is set by the filter toggle key. Two values are given 0.05 - 35 Hz (or 25 Hz) and 0.05 - 150 Hz. See Myogram filter later in this chapter.
- The speed in mm/s for the printout.
- Sensitivity in mm/mV for the printout.

  These are set by the top line keys on the alpha- numeric keyboard (see the dual purpose key table on the following page).
- The number of channels and the selected leads for the printout. This is set by the Printer Channel key. 3, 6 or a user defined number of leads can be selected; the configuration is shown after the lead number.

WHAT DO THE KEYS DO?



DUAL PURPOSE KEYS	
KEY	**FUNCTION**
'1' to '6'	Printout Speed Selection 2.5, 5, 10, 12.5, 25, or 50 mm/s
'8' to '_'	Printout Sensitivity Selection 2.5, 5, 10, or 20 mm/mV

KEYBOARD KEYS	
KEY	**FUNCTION**
DELETE	Delete character to the left of the cursor.
ENTER	Confirm entry or selection.
SPACE	Enter blank space into the text.
⇑	When pressed simultaneously with a letter key it activates the upper case letter. When pressed simultaneously with a number key it activates an alternative symbol set.
⇪	Toggle key to set lower case or upper case letters. The Caps Lock key status is indicated on status information field on the right-hand side of the screen.

Alpha-Numeric Keypad

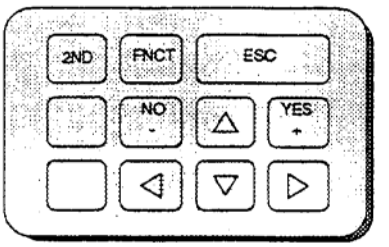
The top line of the alphanumeric keyboard is dual purpose and when the unit is in the ECG mode, the number keys double as control for the direct setting of *printer* speed and sensitivity. Otherwise, the alphanumeric keyboard serves as a normal keyboard for data input.

Note that the dual purpose keys effect printer speed and sensitivity. Monitor speed and sensitivity are defined by the Monitor keys detailed later.

The functions of the dual purpose keys on the alphanumeric keyboard are given on the following table.

General Control Keys

The general purpose keys to the right of the alphanumeric keypad, are as follows:



FNCT — Calls up the main menu or, if a menu is displayed, returns to monitor mode i.e. displays the ECG.

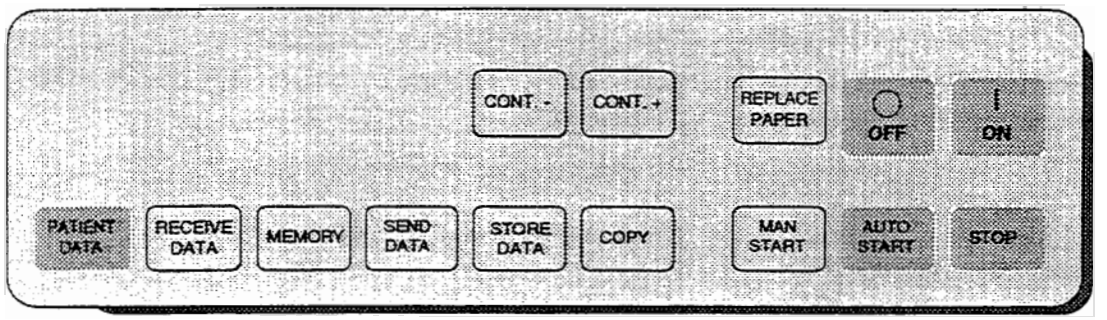
ESC — Return to the previous menu.

YES + / NO - — Change setting / disable command - for use in certain menu options when prompted.

2ND — Select second function or menu. Details of the use of this key are given where applicable later in this book.

The direction keys are used to move the cursor in order to make menu selections.

The control keys situated at the top of the keyboard are general control and instruction keys as follows:



Entering Patient Details

The patient data field is displayed when this key is pressed. Use this field to enter all patient details. The details entered here are printed on the ECG.

Copy

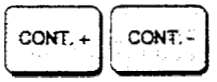
Initiates a copy of the stored ECG.

Changing the Paper

This key extends the paper tray for paper replacement. After paper replacement (paper tray extended) pressing this key again withdraws the paper tray.

Stop Printout

This key stops any printout that is being processed. Pressing this key a second time moves the paper to the start position.



Adjusting the Contrast of the LCD

The contrast of the LCD is adjusted with these keys.

Start ECG Recording

This key Initiates ECG printing.

Start Auto ECG Recording

This key initiates auto recording of an ECG according to the defined parameters.

Full details of all ECG recording and the parameters that can be programmed are given in Chapter 2.

Data Reception from Another Device

This key initiates receive mode recieve . This key also terminates receive mode.

Data Transmission to Another Device

This key initiates transmit mode to transmit an ECG to another unit. Pressing this key displays the transmit menu.

Store Data

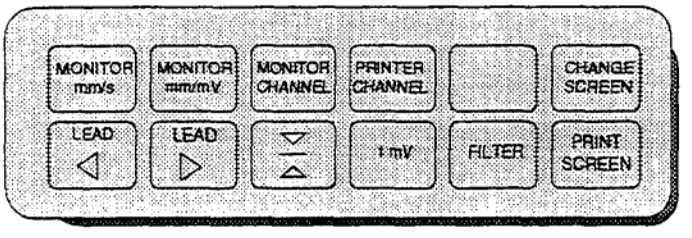
This key initates data storage to the units memory.

ECG Archive

This key displays the data archive and recall menu.

Full details for transmission, reception and storage of ECGs are given in Chapter 3.

The Control keys situated in the middle of the keyboard are general display and printer controls and are as follows:



ECG Leads on the Monitor

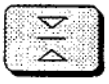
When the unit is switched on the screen shows an ECG group. Selection is between 3, 6 or 8 display channels.

Select Lead Groups

The lead grouping may be displayed in various combinations when 3 or 6 leads are selected. Note that variations of lead groups is only possible if three or six monitor channels are selected - the 8 channel grouping is fixed. See Paragraph ECG SETTINGS for selecting the user programmed leads. These keys are also used for changing the lead group when printing in manual mode - details, are given in Chapter 2.

THREE LEAD GROUPS								
I	aVR	V1	V4	programmed lead 1	programmed lead 4	programmed lead 7	programmed lead 10	0
II	aVL	V2	V5	programmed lead 2	programmed lead 5	programmed lead 8	programmed lead 11	0
III	aVF	V3	V6	programmed lead 3	programmed lead 6	programmed lead 9	programmed lead 12	0

6 LEAD GROUPS				
I	V1	programmed lead 1	programmed lead 7	0
II	V2	programmed lead 2	programmed lead 8	0
III	V3	programmed lead 3	programmed lead 9	0
aVR	V4	programmed lead 4	programmed lead 10	0
aVL	V5	programmed lead 5	programmed lead 11	0
aVF	V6	programmed lead 6	programmed lead 12	0



Reset ECG Signal to Baseline

Automatic baseline reset is incorporated into the AT-5. In certain circumstances however, the display can 'drift'. If this happens the baseline of the displayed ECG traces can be reset at any time by pressing the baseline reset key.

Select ECG Display Speed

The speed that the ECG trace moves from left to right on the screen can be adjusted with the monitor mm/s key. Each press of the key toggles the speed between a low and a high value.

The time reference is given on the bottom of the screen indicated by '1 s' and a series of points; the time difference from point to point is 1 sec.

Print Screen

Prints the screen as displayed.

Insert Calibration Signal

At any time during the ECG recording, a 1 mV calibration signal can be manually inserted into the recorded signals by pressing this key. This reference is also given when printing manually.

Select ECG Signal Level

By pressing the key the signal amplification is switched between two different levels:

- between a medium and high level with 3 leads
- between a low and medium level with more than 3 leads

A 1 mV reference mark is given on the left of the screen.

CHANGE SCREEN

Change Screen

Pressing the change screen key toggles the main display between the following:

- ECG leads
- Average values for each lead (only when the Measurement option installed)
- Interpretation statement (only when interpretation option installed)

§ *The average values and interpretation statements can only be displayed after an ECG Auto test has been carried out (and the options are set). See Chapter 2 - Auto Mode ECG Recording.*

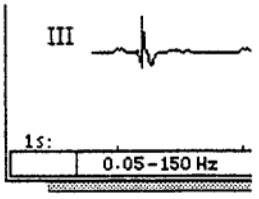
FILTER

Myogram Filter

The myogram filter suppresses disturbances caused by strong muscle tremor. This filter is switched on or off by the filter key.

- 0.05 to 25 Hz or 35 Hz (Myogram filter on)
- 0.05 to 150 Hz (Myogram filter off)

The status of the Myogram filter is shown on the bottom left hand side of the Screen:



The cutoff of the myogram filter is 25 Hz or 35 Hz See FILTERS later in this Chapter.

PRINTER CHANNEL

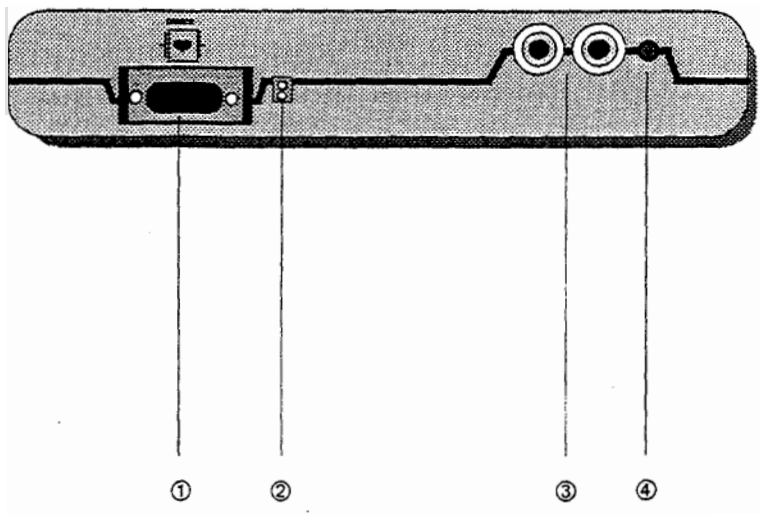
Printer Channel

Defines the lead grouping that will be printed. The channel selection for printout can be 3, 6 or user defined. The channel grouping that will be printed is shown on the display on the bottom line. See the next chapter for details on manual printing.

Note: Slight functional differences may exist in different modes.

EXTERNAL CONNECTIONS

Side Panel



The following are located on the side panel:

1. EKG / ECG Socket for patient cable

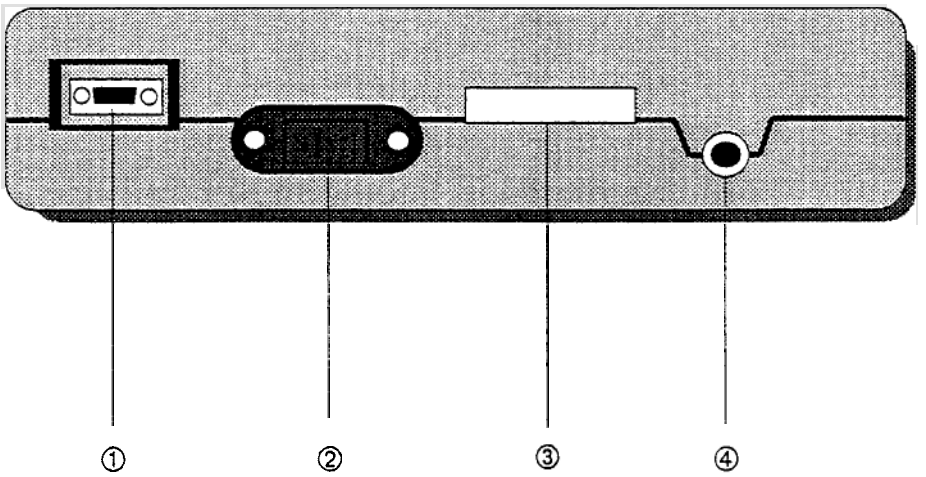
Note: **The socket is CF rated, that is fully** floating and isolated, defibrillation protected, and may be used for intra-cardiac application.

CAUTION

DEFIBRILLATION PROTECTED ONLY IF USED WITH THE ORIGINAL WELCH ALLYN PATIENT CABLE.

2. ECG Cable Tester
3. **DC inputs: DC1**, DC2 - 0.5 V/cm
4. Reset Key - all stored information is lost when this button is used. If the unit ' hangs-up', use a small screwdriver to reset.

Back Panel



The following are located on the back panel:

1. RS-232 port for data transmission / reception
2. Mains Connector
3. Program Pack
4. Potential equalisation (ground) connection

PUTTING THE UNIT INTO OPERATION

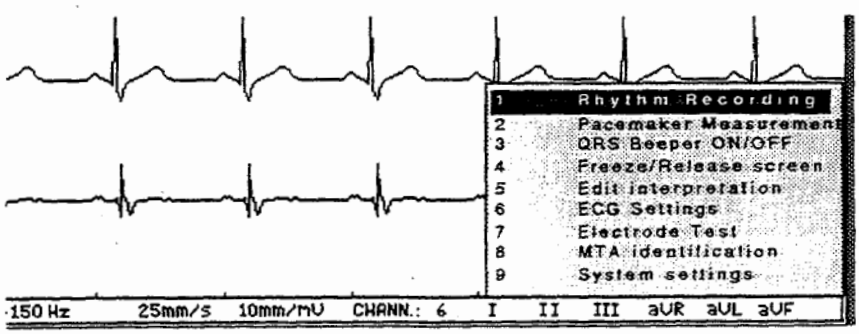
Menu Structure

All test functions, setup definitions, and operations are carried out at the press of a key via the simple window menu structure. To call up a menu for any of the main functions simply press the respective function key.

Selecting a Menu Item

When in a menu simply press the number displayed on the left of the option to select that menu item. Alternatively, use the cursor to highlight the required option and then press **ENTER**.

For example pressing the **FNCT** key displays the main menu as follows:



If you wished to select the 'Rhythm Recording' option from this menu either the **1** key could be pressed or, (because that option is highlighted) the **ENTER** key.

Leaving a Menu

Leaving a menu is the same for all displays:

The **ESC** key returns you to the previous menu.

The **FNCT** key leaves the menu structure completely and returns you to the main display.

Note: The same keys are pressed to leave any menu or data field.

Input Text

Type the desired text and finish by pressing the **ENTER** key to store the entered text.

Note: An error message is given and the **"?"** sign appears if an input can be detected as clearly incorrect e.g. entering month '13'. If this happens check your entry and make the appropriate corrections.

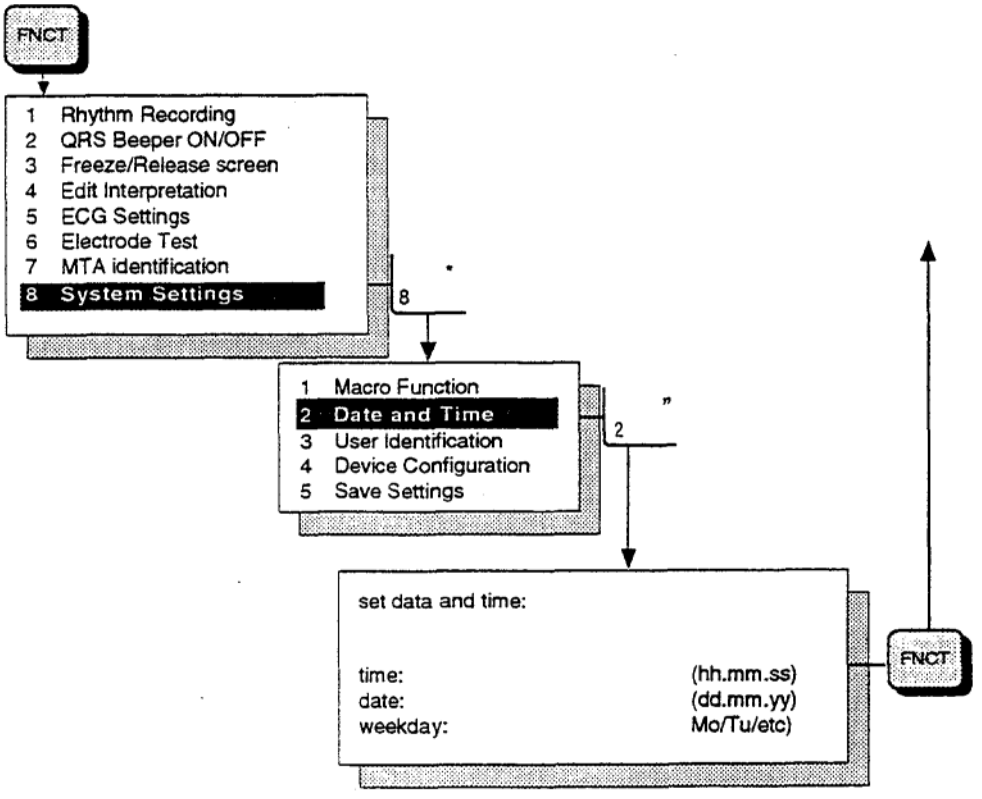
Delete Text

By pressing the **DELETE** key the previously typed character is deleted.

SYSTEM SETTINGS

Adjusting Date and Time

The SCHILLER AT-5 contains a calendar clock for which the number of days per month and the leap years are already preprogrammed. The time and data appears on the LCD and the printout.



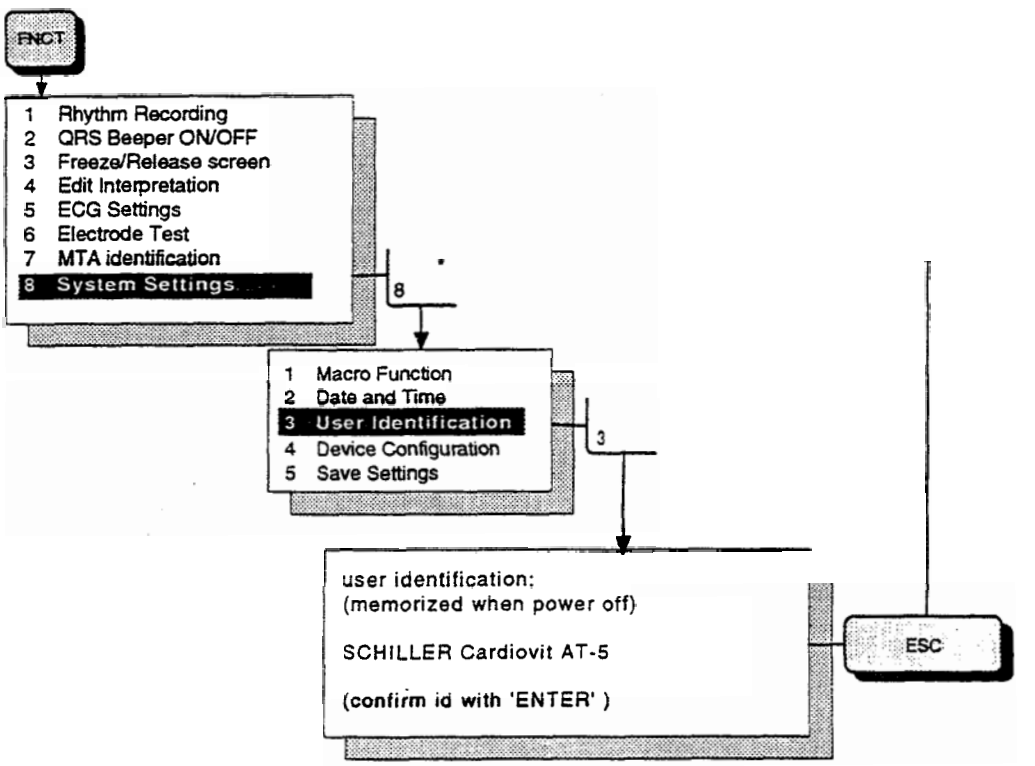
Time	Separate the hours, minutes and seconds with a full stop (e.g. 18.05.00 for 6.05 pm).
Date	The date is entered as day, month, year (in the USA: month, day, year). For example, for 11th December 1994, enter "11.12.94" (in the USA: "12.11.94") separating day, month and year with a full stop.
Weekday	The day of the week is entered by typing in the first two letters of the day, i.e. Mo, Tu, We, Th, Fr, Sa, Su.

The newly entered date is valid as soon as ENTER is pressed.

If any invalid values are entered the whole input is deleted and a question mark appears. The cursor remains on the same line so that new, correct values can be entered.

User Identification

This function enables entry of the name of the physician, clinic or department which is then identified on each ECG printout.



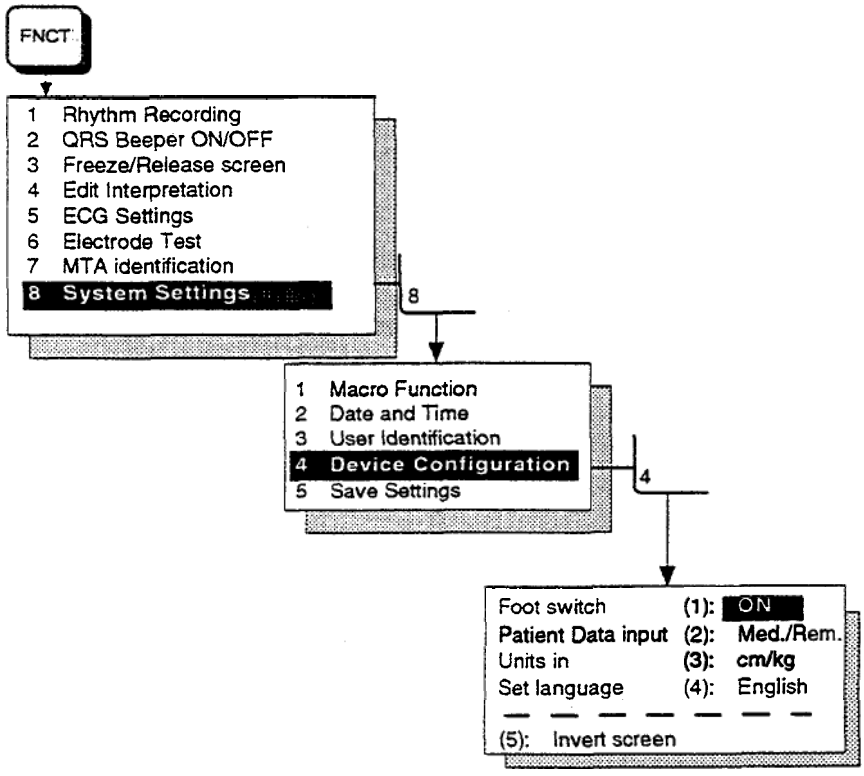
The maximum number of characters for the entry is 31.

The message ** Input accepted ** indicates that the settings are stored.

Device Configuration

In this menu you can:

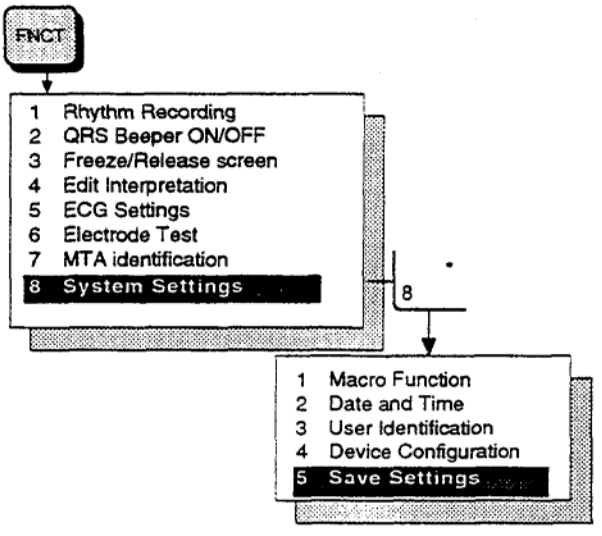
- Enable an auto mode printout (format 2) with a footswitch. This can be used, for example when running a stress test when it may be required to initiate an ECG printout at a distance. With key 1 set to on or off (for connection and use of the footswitch see chapter 2, page 22). When this is set to on, auto mode ECG recordings can still be made from the keyboard.
- Set the comment field in the patient data menu. With key 2 select between Room/Doctor, Room/Remarks, Doctor/Remarks, Medication/Remarks, Medication/Doctor or Medication/ Doctor. This is printed for written comments that can be entered when the PATIENT DATA key is pressed.
- Set the measurement units between cm/Kg or lbs/ins. These are the units used when the PATIENT DATA key is pressed (and on the printout).
- Set the language for the display and the printout. With key 4 select between German, English, French, Swedish, American and Italian. Note that the difference between English and American is in some of the defaults, e.g. units in English is metric, when American is selected the units are Lbs/ins.
- Toggle the display between negative and positive image. Set according to your preference.



To activate the settings made, proceed as follows: Press key ESC to return to the previous menu, select "Save Settings" from this menu, press the **ENTER** key and switch off the unit. When switching it on again, it will automatically load the selected settings as the default.

Saving the Setup

Certain adjustable parameters are stored as default setups and remain permanently stored (even when the unit is switched off) until overwritten.



The following parameters are stored:

Automatic mode: This refers to the automatic mode format for resting ECG recording.

Programmable lead group: This refers to the user programmable lead group.

Cabrera / Standard leads: This refers to the ECG lead sequence.

Number of channels: This refers to the user-defined number of channels which can be selected for the printout of a resting ECG recording.

By pressing ENTER the listed settings will be permanently stored and confirmation is given by the message *** Settings memorized! ***.

Press FNCT to return

Note: All previously stored settings are overwritten with the new values.

Full details of all ECG recording procedures and the parameters that can be programmed are given in the following chapter.

ECG SETTINGS

Lead Sequence

Different lead groupings can be specified when carrying out an ECG test. How to specify the grouping is given in Chapter 2. Basically three options are available in the ECG lead sequence:

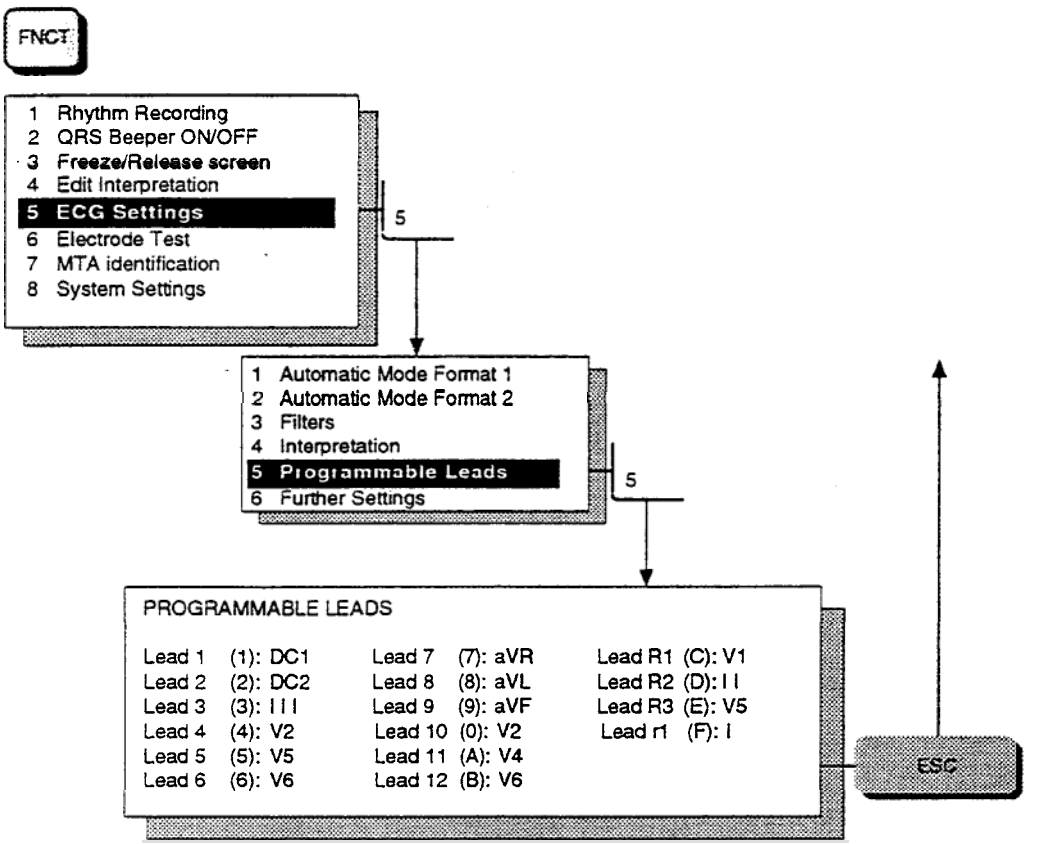
¶ Standard -> I II III aVR aVL aVF V_1 V_2 V_3 V_4 V_5 V_6

¶ Cabrera -> aVL I -aVR II aVF III V_1 V_2 V_3 V_4 V_5 V_6

¶ User defined

The user defined lead group must be programmed before a test is run and a user defined lead grouping specified. Once programmed the lead group will remain stored until changed. To define the user programmed lead group proceed as follows:

Defining Individual Lead Sequence



The table shows the currently programmed leads. The numbers '1' to '0' and letters 'A' to 'F' are pressed to select the desired format for leads 1 to 12 and rhythm leads R1 to r1 respectively. The leads are changed with the + and - keys.

The four leads to the right (R1, R2, R3, r1) are the leads selected for rhythm recording (long term ECG recording). In Auto mode R1 R2, R3, and r1 are used (three Rhythm strips selected - R1, R2 and R3 are recorded, one Rhythm strip is selected - r1 is recorded). When a manual long term recording is being carried out, R1 is used.

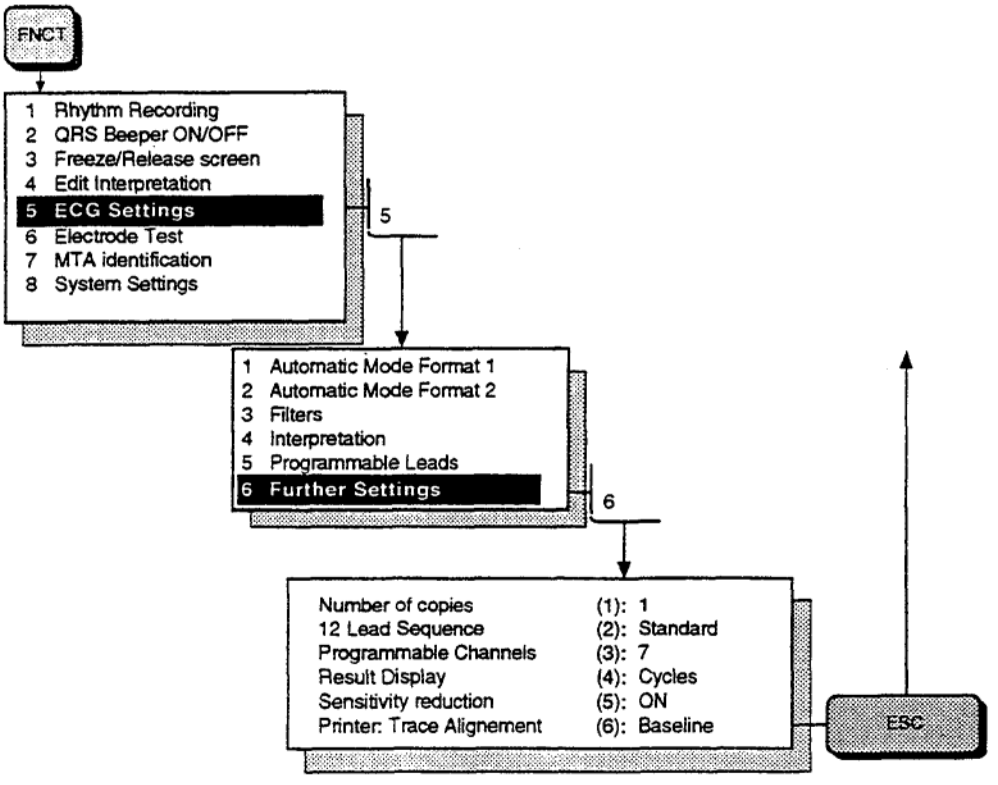
§ *The DC 1 and DC 2 leads refer to the external DC inputs on the side panel. When these are set the DC input for an external device is displayed in the relevant position.*

Two dashes '--' indicate that no lead is programmed for that position.

Press lead keys

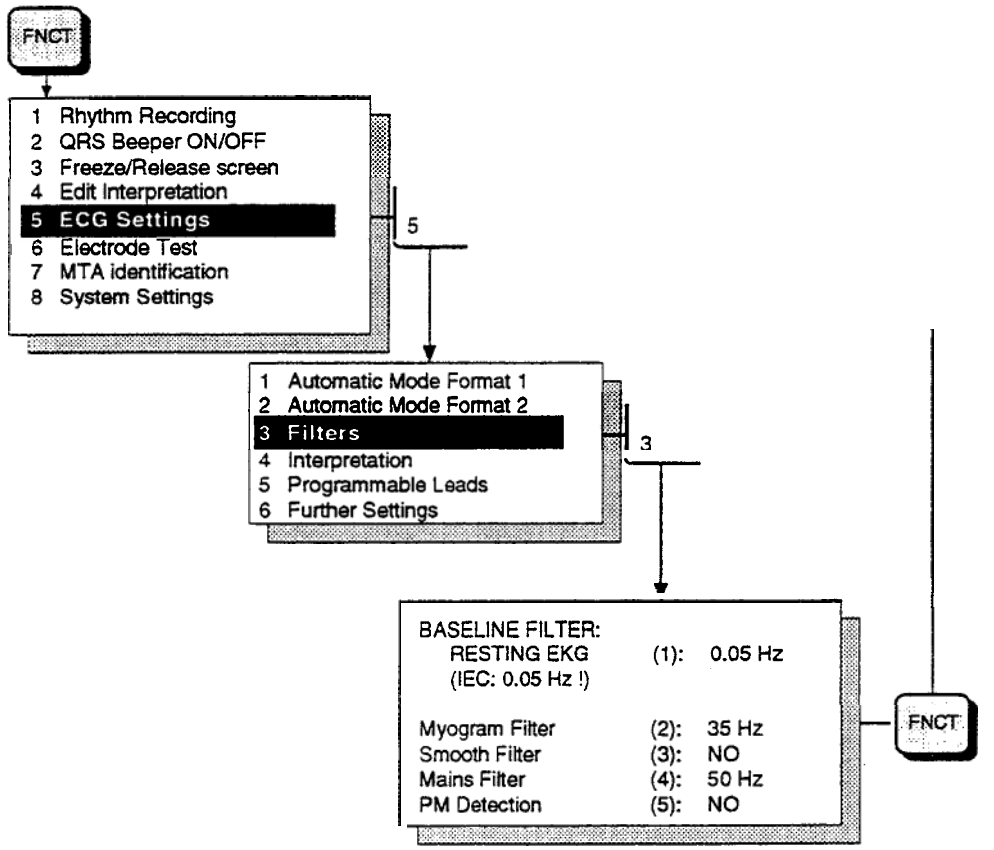
until the new lead sequence appears on the display.

Standard or Cabrera



Select at the position **"12 Lead Sequence"** either **"Standard"** or **"Cabrera"**.

Setting the Cutoff of the Myogram and Other Filters



Baseline Filter

The baseline filter suppresses excessive baseline drifts. Select between:

¶ 0.05 Hz, 0.12 Hz, 0.25 Hz, 0.50 Hz

This should usually be set to 0.05 Hz (IEC recommendation) giving a frequency range of 0.05 Hz to 150 Hz. Any other value should only be used if absolutely necessary as the ECG signal, especially in the ST segment can be affected. Changes of the above values are only valid after the filter key is pressed.

Myogram Filter

The use of the Myogram filter reduces muscle induced noise. Average cycles and measurements are not affected by this filter.

Select between 0.05 - 25 Hz or 0.05 - 35 Hz.

Smooth Filter

The SCHILLER Smoothing Filter (SSF) is a low pass filter which suppresses high frequency artefacts between the QRS complexes. The SSF does not affect to the QRS complex, i.e. the signal itself remains unchanged.

Select between **YES** or **NO.**

NOTE: ***When recording an ECG with a pacemaker patient, the pacemaker detection must not be activated and must be switched off (see 'Pacemaker Detection'), otherwise the pacemaker pulses may not be detected.***

Mains Filter

The mains filter is an interference filter that suppresses AC interference without distorting the ECGs. The selection is 50 Hz (for most of Europe) or 60 Hz (USA and other countries).

Pacemaker Detection

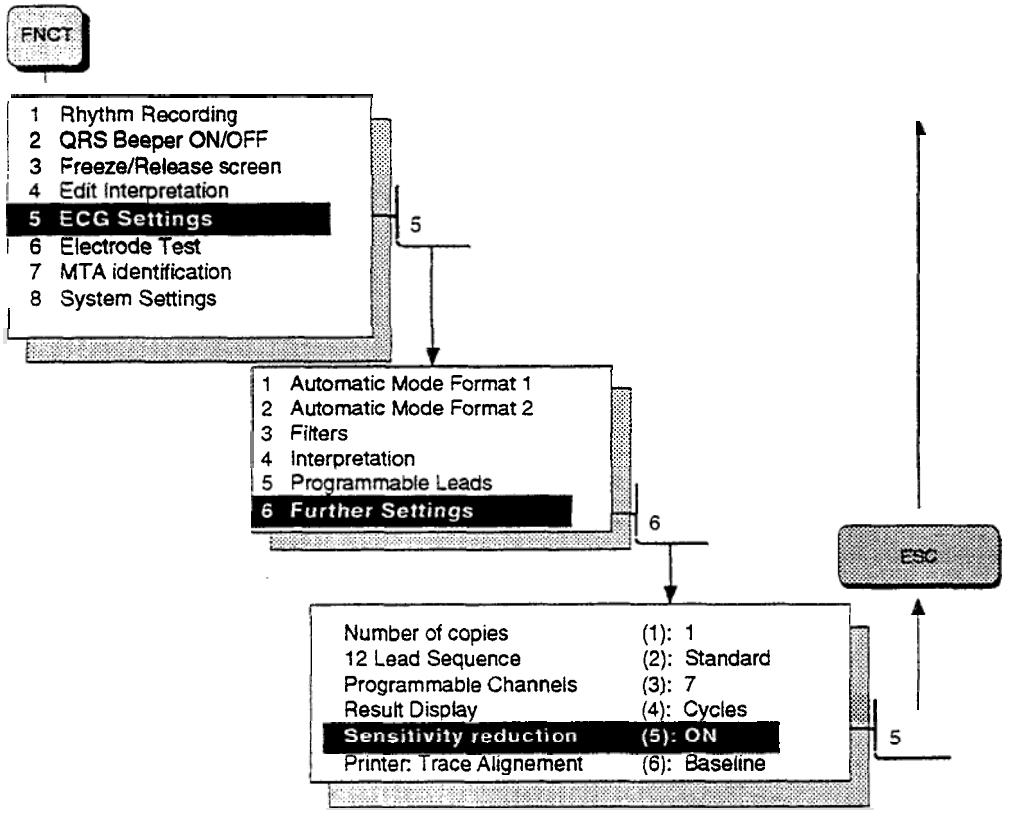
To activate the pacemaker detection press key **5** in the "Filters" menu and set to "YES".

NOTE: Pacemaker pulses are indicated, on the screen and on the printout as squarewave pulses.

Automatic Adjustment of Signal Level

All leads are recorded with the sensitivity of 10 mm/mV unless the amplitudes are too high which would mean that the QRS peaks would overlap too much; in this case the sensitivity is reduced automatically to 5 mm/mV.

If automatic reduction in sensitivity is *NOT* required, it can be switched off as follows:



NOTE: The switching on or off of the automatic sensitivity adjustment affects only the presentation of the leads on the automatic ECG printout. Display sensitivity reduction is achieved with the MONITOR mm/mV *key.*

QRS Beeper

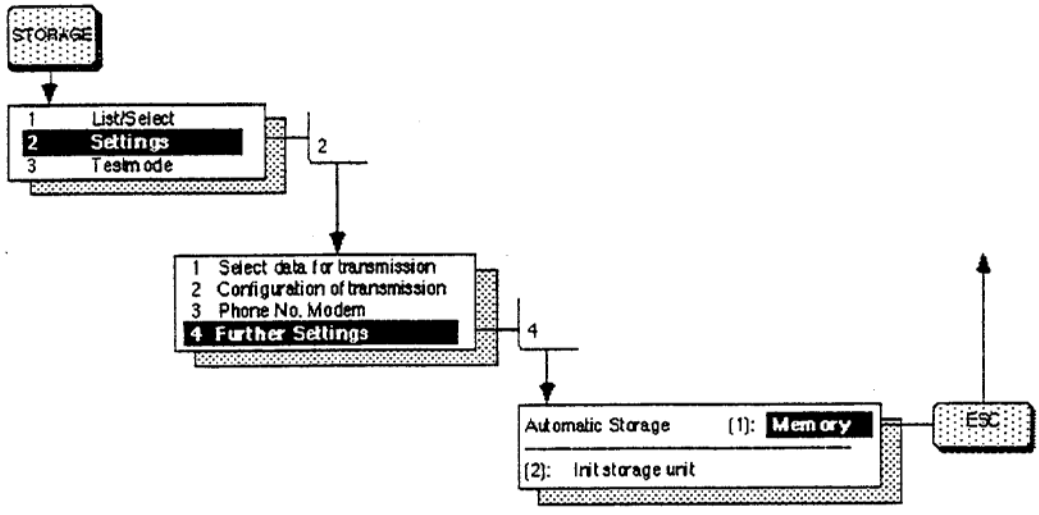
Acoustic indication of the heart rate can be provided by means of the QRS beeper. This signal can be turned on or off from the function menu. Press FNCT and the option 'QRS Beeper ON/OFF' toggles the QRS acoustic beeper.

Freeze Display

The ECG signals displayed on the screen can be "frozen" at any time for closer examination. This function is useful when a printout of a certain ECG is required. Press FNCT and the option Freeze/ Release screen' toggles the freeze screen. The recording of the ECG continues while the screen is frozen.

AUTOMATIC STORAGE & TRANSMISSION SETTINGS

The AT-5 provides you with the possibility to store or transmit an ECG automatically after recording. To set this function proceed as follows:



The possible selections are:

Transmit Direct data transfer to an external unit (e.g. SEMA).

Memory Data storage to the memory of the AT-5.

NO No automatic storing.

Check Chapter 3 for details to set up data for storage and transmission.

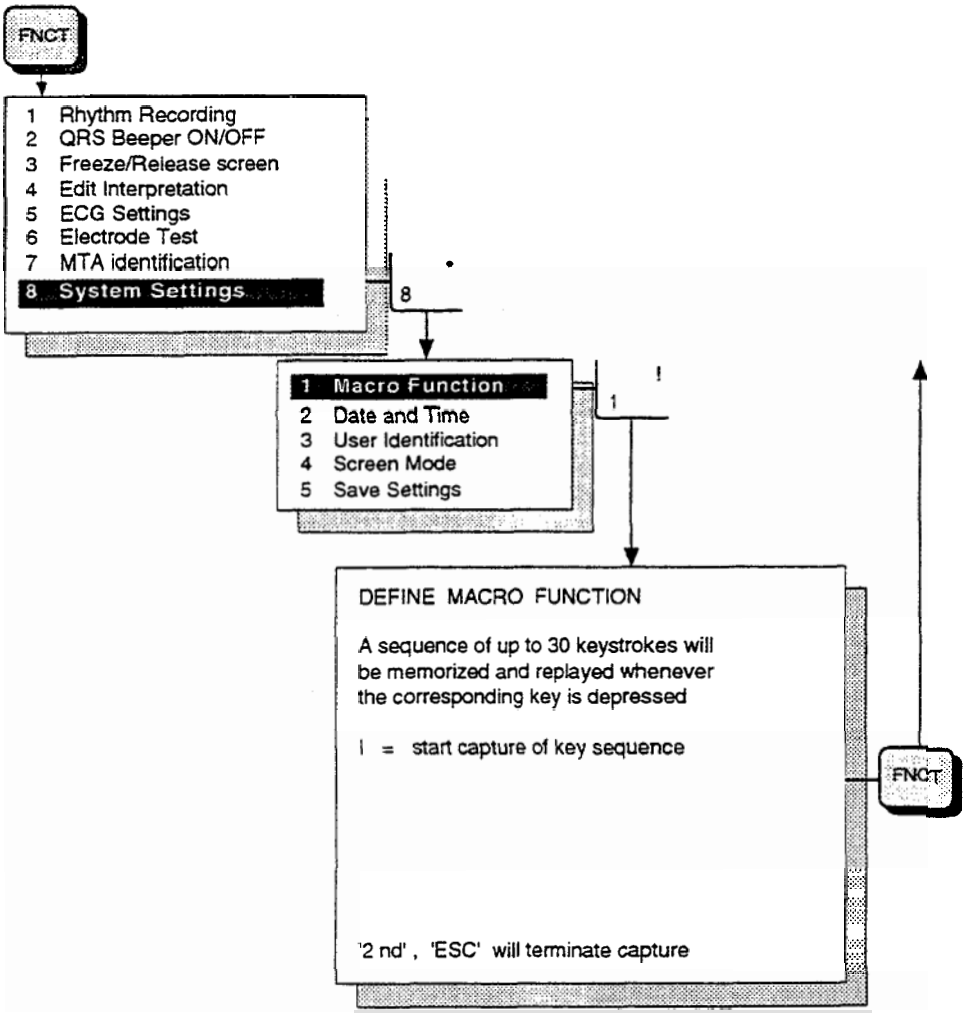
(2): Init storage unit: This is a service tool and has no function to the user.

RECORDING USER DEFINED SEQUENCES (MACRO FUNCTION)

Any series of operation steps (or key strokes) can be programmed together in the form of a single **MACRO** function. This can be very useful to store often used procedures without having to re-enter all the data and parameters. All stored settings are recalled by pressing just one key.

The AT-5 can store up to 6 separate macros; and each single macro can be programmed to store up to 30 steps. It is worthwhile spending a few minutes to familiarise yourself with the Macro function - they can save you a lot of time and greatly simplify operation.

Before a macro is programmed, try out the steps first, note down the keystrokes and make sure they work. When a Macro has been programmed keep a record of all the steps and the result i.e. what the macro does, for future reference.



How to Store a Macro

To program a macro proceed as follows:

1. **Press key** FNCT.

2. **Press key** 8 .

3. **Press key** 1 !.

You are now in the Macro menu and you can commence to series of steps that you wish to store.

4. **Start the recording by pressing key** I **(I for input).**

5. **Select a key from** 1 ! **to** 6 .

This will be your macro number - 1 to 6. If a different key is pressed and an error message is displayed with an acoustic signal, Try again. On the display the selected key appears as "**F1**" to "**F6**".

6. **Now enter the series of keystrokes that you wish to be recalled when this macro is selected.**

   IN MENUS WHERE A CHOICE OF SELECTIONS EXISTS, THE SELECTION MUST FIRST BE PRESET TO A KNOWN VALUE SO THAT THE UNIT KNOWS THE 'STARTING POINT'. TO DO THIS, WHENEVER A MULTIPLE CHOICE MENU OPTION IS TO BE PROGRAMMED, THE SLASH KEY (/) MUST FIRST BE PRESSED TO SET THE OPTION TO A KNOWN VALUE (THE FIRST OPTION). SEE THE FOLLOWING EXAMPLE.

7. **Finish the recording by pressing the keys** 2ND **followed by** ESC.

The saving of the macro is confirmed by an acoustic signal. The recording is stored until the function key is used again for a new macro.

How to Recall a Macro

Note: To recall a MACRO the screen must be 'clear'. That is no menu displayed.

1. **Press key** 2ND.

2. **And then the appropriate function key** 1 ! **to** 6 .

MACRO EXAMPLE

Suppose you wish to set AUTO MODE 1 so that it changes its current print setting format (whatever it is) to, for example 4*3 leads with 3 rhythm leads. You want Macro one (F1) to be used. To program this you would press the following keys:

1. *Enter the MACRO menu and specify that the following key sequence is to be remembered as MACRO 1.*

   <FNCT> <8> <1> <I> <1>

2. *Enter the key sequence that will be run every time that MACRO 1 is selected.*

   <FNCT> <5> <1> </>

   (slash key (/) resets ECG leads to known setting - in this case -------)

   <+> <+>

   (second ECG setting option - 4*3 leads + 3 rhythm)

   <FNCT>

   (to exit menu)

3. *Exit Macro menu (and store MACRO 1 to the entered key sequence).*

   <2ND> <ESC>

This key sequence is now programmed to macro one. **To recall MACRO 1 simply press:**

<2ND> <1>

Of course this is a very simple example, but you should be seeing the advantages of macros and how useful this function could be to store, for example commonly used ECG recording procedures.

AT-5 TECHNICAL OVERVIEW

A brief overview of the technical details of the AT-5 is given below.

Dimensions (l/w/h):	260 x 205 x 60 mm
Weight:	approx. 2.7 kg
Power supply requirements:	100 to 240 Vac, 50 / 60 Hz
Power consumption:	25 W
Battery:	9.6 V Nickel Metal Hydride Battery Pack giving one hour of continuous use (without using printer)
Printing process:	high-resolution thermal printhead, 8 dots per mm (amplitude axis), 40 dots per mm (time axis) @ 25 mm/s
Paper speed:	2.5 / 5 / 10 / 12.5 / 25 / 50 mm/s
Sensitivities:	2.5 / 5 / 10 / 20 mm/mV
Recording tracks:	3, 6 or user defined channels, automatic baseline adjustment
Chart paper:	thermoreactive, Z-folded,
Liquid crystal display:	Backlighted liquid crystal display for ECG monitoring and alphanumeric information
Test socket for patient cable:	for testing of electrode cables for interruptions and short-circuit; control light indication
Safety standard:	CF according to IEC 601-1 and IEC 601-2-25
Protection class:	I according to IEC 601-1
Environmental conditions:	temperature, operating: 10° to 40° C temperature, storage: 0° to 50° C relative humidity: 25 to 95% (non-condensing)
Keyboard:	splashproof keys
Data record:	Listing of ECG recording data, date and time of recording, patient data, etc. **Version M & i:** ECG measurement results (intervals, amplitudes, electrical axes), average complexes with optional measurement reference markings **Version i:** ECG interpretation statements
Long-term rhythm recordings:	1 lead, 60 sec / page 1 lead, 3 min / page 1 lead, 6 min / page 1 lead, 20 min / page

ECG storage:	Output memory for 10 s (12 ECG leads)
Myogram filter (muscle tremor filter):	adjustable at 25 or 35 Hz, only effective for printed ECG
Line frequency filter:	distortion-free suppression of superimposed 50 or 60 Hz sinusoidal interferences by means of adaptive digital filtering
Experimental Inputs DC1, DC2:	Jack plug positive and negative maximum input voltage 1 cm / 0.5 V (100 kΩ), 3.0 V p-p.
RS-232 Serial Interface:	Protocol: Asynchronous Baud Rate: 75 to 153600 Baud Byte Format: 1 start bit, 8 data bits. 0 or 1 parity bit (+ or -), programmable 1 / 1.5 / 2 stop bits, programmable.

CHAPTER 2

HOW TO RECORD AN ECG

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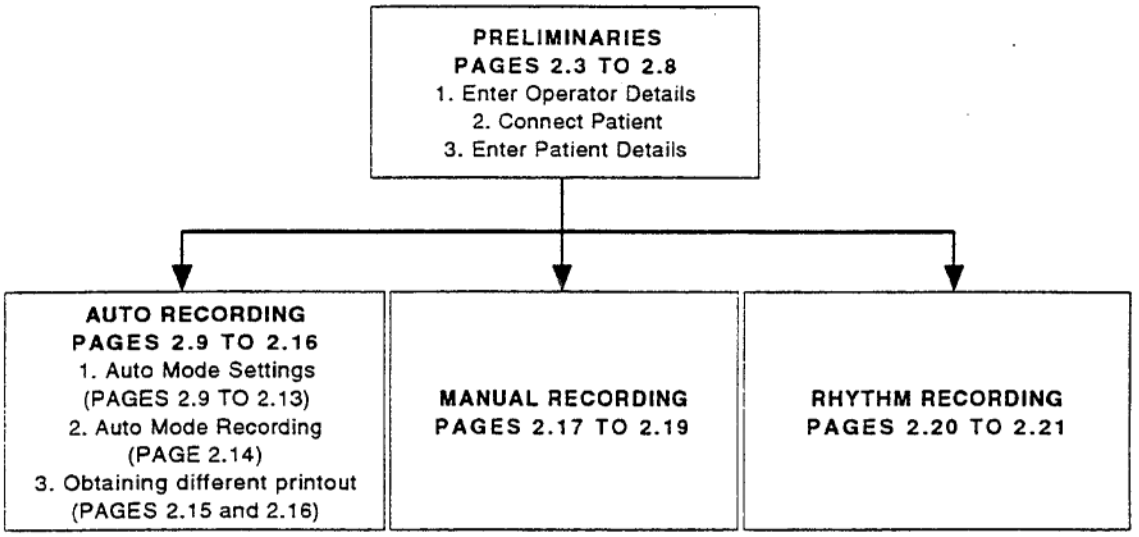


INTRODUCTION

There are three methods of ECG recording with the AT-5; these are Manual, Automatic and Rhythm (long term). In manual mode, the real-time ECG recording is stored for a period of 10 seconds in the input memory and is continually renewed. A continuous printout can be obtained in various lead configurations.

The Automatic mode enables an ECG recording to be performed and predefined information (specified by the user) to be given at the touch of a button. The ECG signals are transferred from the input memory to a working memory for processing and averaging and a printout given of the processed data.

The number of channels, the lead group, the speed and the sensitivity can be freely selected as described in Chapter 1. The selection of the display format is the same whether in manual or automatic mode, however the format of the printout in automatic mode is preprogrammed before commencing the recording.

General Ancillary information not directly required in the recording procedures, is detailed in Chapter 1. For full details about the SCHILLER ECG interpretation and measurement programs please refer to the separate publication "Guide to the ECG Interpretation and Measurement Programs" (article no. 2.510 172).

CHAPTER 2

HOW TO RECORD AN ECG

PRERECORDING PRELIMINARIES

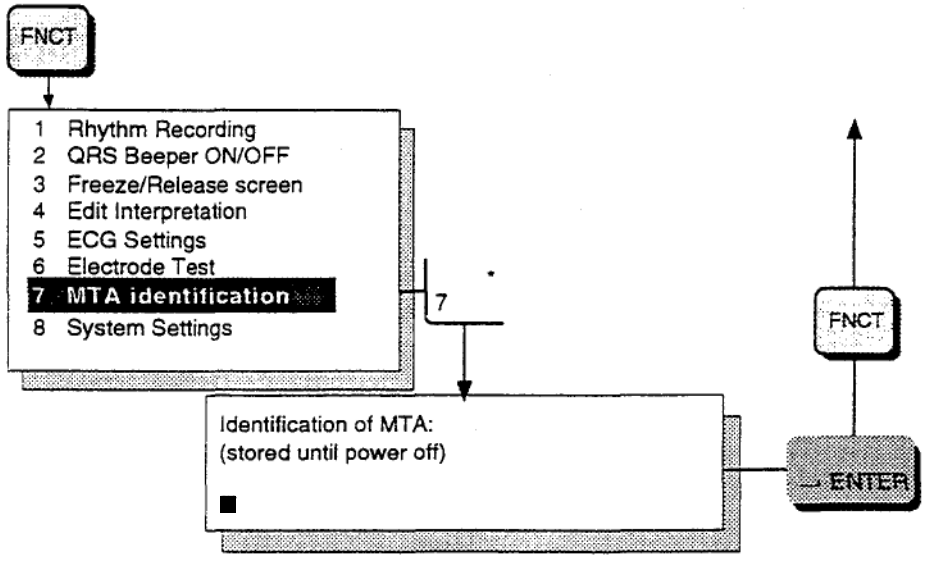
The following prerecording preliminaries must be carried out before recording an ECG (in manual or automatic mode). Proceed as follows:

1. Switch the unit on and enter the MTA Identification

This function is to register the name of the medical assistant carrying out the recording and must be entered every time the unit is used. The MTA is identified on each ECG printout.

Note: The name of the physician , clinic or department which is also identified on each printout is entered via the System Setup menu and is remembered when the unit is switched off. This is usually entered only once when the unit is initially commissioned. This procedure is to enter the identification of the person carrying out the ECG.

Enter the MTA identification as follows:

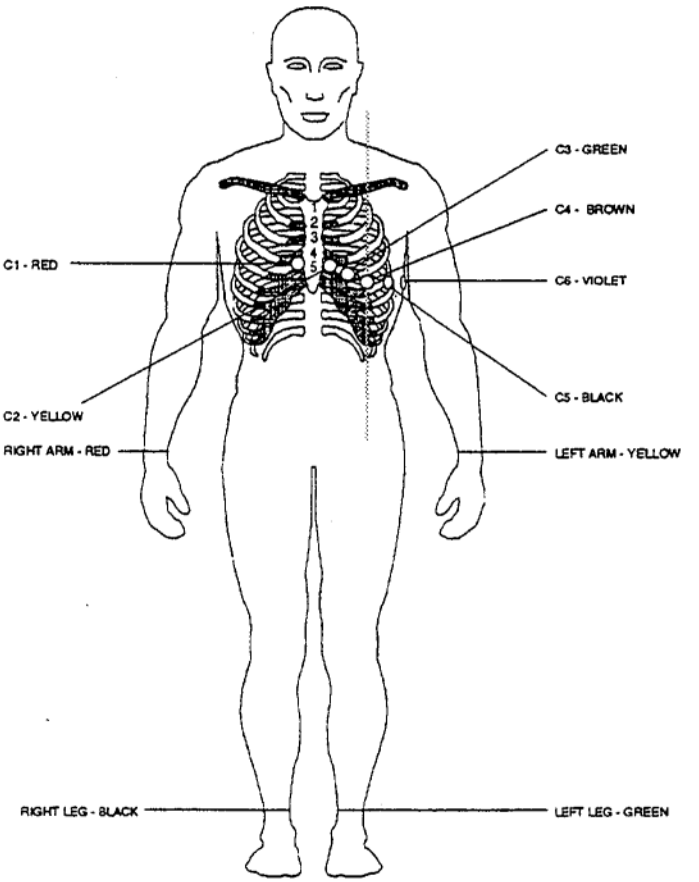


The maximum number of characters is 23.

2. Connect the Electrodes to the patient.

TO ENSURE IMPECCABLE QUALITY, ONLY USE GENUINE SCHILLER PATIENT CABLE AND ACCESSORIES.

The standard Wilson Configuration is shown here in IEC format.
AHA format is given in the table below:



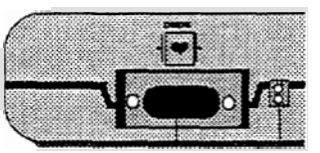
IEC		AHA	
N	Black	RL	Green
R	Red	RA	White
C1	White/Red	V1	Brown/Red
C2	White/Yellow	V2	Brown/Yellow
C3	White/Green	V3	Brown/Green
C4	White/Brown	V4	Brown/Blue
C5	White/Black	V5	Brown/Orange
C6	White/Violet	V6	Brown/Violet
L	Yellow	LA	Black
F	Green	LL	Red

The quality of the ECG is dependent on the preparation and the resistance between the skin and the electrode. To ensure a good quality ECG and minimise the skin/ electrode resistance, remember the following points:

1. *Ensure that the patient is warm and relaxed.*
2. *Shave electrode area before cleaning*
3. *Thoroughly clean the area with alcohol*
4. *When applying the electrodes ensure that a layer of gel is between the electrode and the skin.*
5. *Place the C4 electrode first - in the 5th intercostal space on midclavicular line so that it lines up approximately with the middle of the clavicle. Then place:*
   - ¶ *C1 in fourth intercostal space at right sternal border*
   - ¶ *C2 in fourth intercostal space at the left sternal border*
   - ¶ *C3 between, and equidistant to, C4 and C2*
   - ¶ *C6 on left midaxillary line on the same level as C4*
   - ¶ *C5 between, and equidistant to, C4 and C6*

Following these simple guidelines will ensure good results every time.

3. **Plug the patient cable into the cable socket on the right-hand panel marked EKG/ECG**



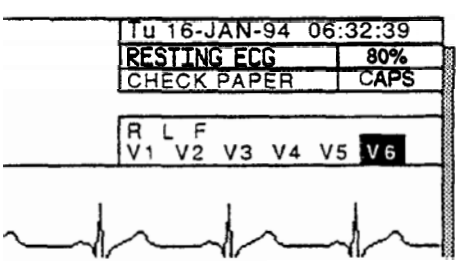
CAUTION:

ENSURE THAT NEITHER THE PATIENT OR THE ELECTRODES COME INTO CONTACT WITH OTHER PERSONS OR CONDUCTING OBJECTS.
DEFIBRILLATION PROTECTED ONLY IF USED WITH THE ORIGINAL PATIENT CABLE!

The ECG is now displayed. At any time during the ECG recording, a 1 mV calibration signal can be manually inserted into the recorded signals by pressing the

key.

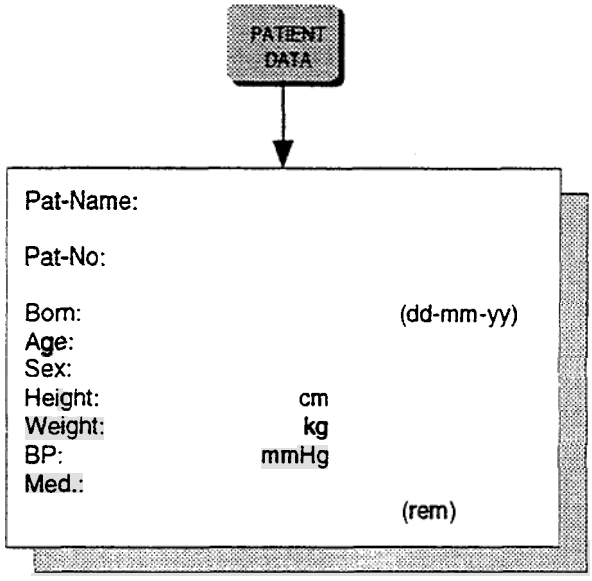
§ *If a lead-off is detected at any time on any of the electrode connections, an audible alarm is given and the electrode that is off flashes. When this happens reapply the electrode. In the example shown below electrode V6 is off.*



In exceptional circumstances if the indicator continues to flash, it can indicate a problem with the patient cable. Use the cable tester (detailed in Chapter 4) to check the patient cable.

4. Enter the Patient Data

Each ECG is printed with the patient data. The patient data remains stored until overwritten.



Pat - Name:	Patient name (max. 22 characters)
Pat. No.:	Patient number (max. 22 characters)
Born:	The date of birth has to be entered in figures in the order "day.month.year" separating each with a full stop. For example, for 3rd November 1936, enter "3.11.36" or "03.11.36"
Age:	The age is calculated by the unit on the basis of the date of birth. Up to 2 years: Number of months up to 6 years: Number of years and months over 6 years: Number of years
Sex:	(max. 22 characters, only 1 character necessary: M/F)
Height*:	Height in centimetres (or in inches for the USA) (max. 3 digits)
Weight*:	Weight in kilogrammes (or in pounds for the USA) (max. 3 digits)
BP:	Blood pressure in mmHg (max. 7 digits) systolic/diastolic: *sss/ddd* or *sss.ddd*
Med*:	Medication (max. 16 characters)
(rem*)	Line for remarks (max. 22 characters)

Confirm each entry with ↵ENTER

(*) Options are set in the Unit Configuration menu (FNCT - 8 - 4).

Wrongly typed characters can be deleted with the key ←DELETE . Whole lines are deleted as soon as a character is entered at the first position.

Normal text Editing functions are used. Special editing functions are as follows:

- ¶ 2ND followed by Right arrow key — moves the cursor to the beginning of the line
- ¶ 2ND followed by Left arrow key — moves the cursor to the end of the line
- ¶ 2ND followed by W — deletes the word where the cursor is positioned
- ¶ 2ND followed by DELETE — deletes the line where the cursor is positioned

AUTOMATIC MODE ECG RECORDING

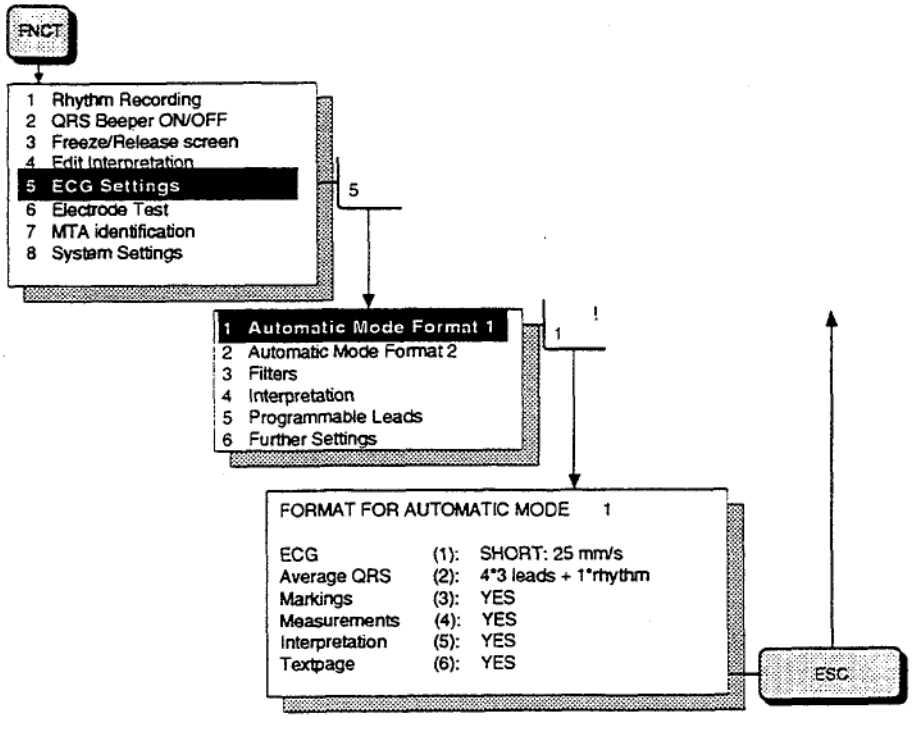
There are several settings which can be made for automatic mode recording which determine the format and content of the printout. *Two* automatic mode formats can be programmed. These are usually programmed when the AT-5 is initially used, but they can of course be reset at any time. The settings that can be defined for automatic mode format, and the automatic mode recording procedure, are given in the following paragraphs.

§ When programmed the lead configuration that is printed is set and is independent of the lead sequence displayed on the LCD or options installed. The following is always given in Automatic mode printouts:

- ¶ Patient Data
- ¶ Heart Rate
- ¶ Date and Time of Recording
- ¶ Sensitivity
- ¶ Speed
- ¶ Filter Setting
- ¶ Software version
- ¶ User name

§ After acquisition of an ECG, a printout can be obtained in either of the two auto mode formats. See "Editing the results and obtaining extra printouts".

Automatic Mode Settings



In both configurations (Automatic Mode Format 1 and 2) the following selections can be made:

ECG Lead Configuration

The configuration of the printed leads is determined by pressing key "1" as follows:

- - - - - - - - - -	No leads are printed.
4 * 3 leads + 1 rhythm	12 leads (4 columns with 3 ECGs each) and one rhythm strip (user programmed lead r1 - see Chapter 1) are printed.
4 * 3 leads + 3 rhythm	12 leads (4 columns with 3 ECGs each) and three rhythm strips (user programmed leads R1, R2 and R3 - see Chapter 1) are printed.
SHORT 25 mm/s	12 leads are printed in "short" format; i.e. over 2 pages (28 cm).
SHORT 50 mm/s	As before, but chart speed 50 mm/s.
SHORT 100 mm/s	As before, but chart speed 100 mm/s.
LONG 25 mm/s	12 leads* are printed in "long" format; i.e. over 4 pages.
LONG 50 mm/s	As before, but chart speed 50 mm/s.
LONG 100 mm/s	As before, but chart speed 100 mm/s.
§	*In a nutshell, LONG formats print twice as many heart beats as the SHORT format.*
prog. leads 25 mm/s	Individually user defined leads on two pages.
§	*Details of how to select the programmed leads are given in Chapter 1.*
prog. leads 50 mm/s.	As before, but chart speed 50 mm/s.
prog. leads 100 mm/s	As before, but chart speed 100 mm/s.
prog. leads (25 mm/s, 5 s)	The last 5 seconds of user defined leads with a chart speed of 25 mm/s.
§	*When SHORT, LONG or prog. lead formats are selected pressing* PRINTER CHANNEL *alters the layout of the printout:*
	¶ *3 channels - 4 columns of 3 ECG leads*
	¶ *6 channels - 2 columns of 6 ECG leads*

Average QRS

Note: Only available if either Interpretation (C) or Measurement (M) option is installed.

The configuration of the printed leads is determined by pressing key '2' as follows:

- - - - - - - - - - - - - - -	No average cycles are printed.
Compact 1 (3 * 4 + 1)	The average QRS cycles of the 12 leads (4 columns with 3 ECGs each) and one rhythm lead (user programmed lead r1) are printed on two pages at a chart speed of 25 mm/s.
Compact 2 (6 * 2 + 1)	The average QRS cycles of the 12 leads (2 columns with 6 ECGs each on two pages) and 1 rhythm lead (user programmed lead r1) are printed on one page.
2 * 6 leads + 2 * rhythm	The average QRS cycles of the 12 leads (6 columns with 2 ECGs each on two pages) and 2 rhythm leads (user programmed leads R1, R2) are printed.
4 * 3 leads + 1 * rhythm	The average QRS cycles of the 12 leads (3 columns with 4 ECGs each on two pages) and 1 rhythm lead (user programmed lead r1) are printed.

Reference Marks for Average QRS

Note: Only available if either Interpretation (C) or Measurement (M) option is installed.

Pressing key '3' provides vertical reference marks at the beginning and at the end of the P wave and QRS complexes and at the end of the T wave. These can be added (YES) or omitted (NO).

Measurement Option *(only available if either Interpretation (i) or Measurement (M) option is installed)*

The ECG measurements contains a printed table of the amplitude value and the time length of each of the 12 leads. Pressing key '4' provides a measurement table of all important parameters at the end of the printout. The table can be included (YES) or omitted (NO).

§ *Note that the table is only printed when 'Textpage' is set (key 6).*

Interpretation Option *(only available if Interpretation (i) option is installed)*

The ECG interpretation contains diagnostic references, that can be printed and appear on the display. Pressing key '5' provides and interpretation of the recorded ECG. The interpretation statements can be included (YES) or omitted (NO).

§ *Note that the table is only printed when 'Textpage' is set (key 6).*

§ *Full details of the interpretation and measurement options are given in the separate publication "Guide to the ECG Interpretation and Measurement Programs".*

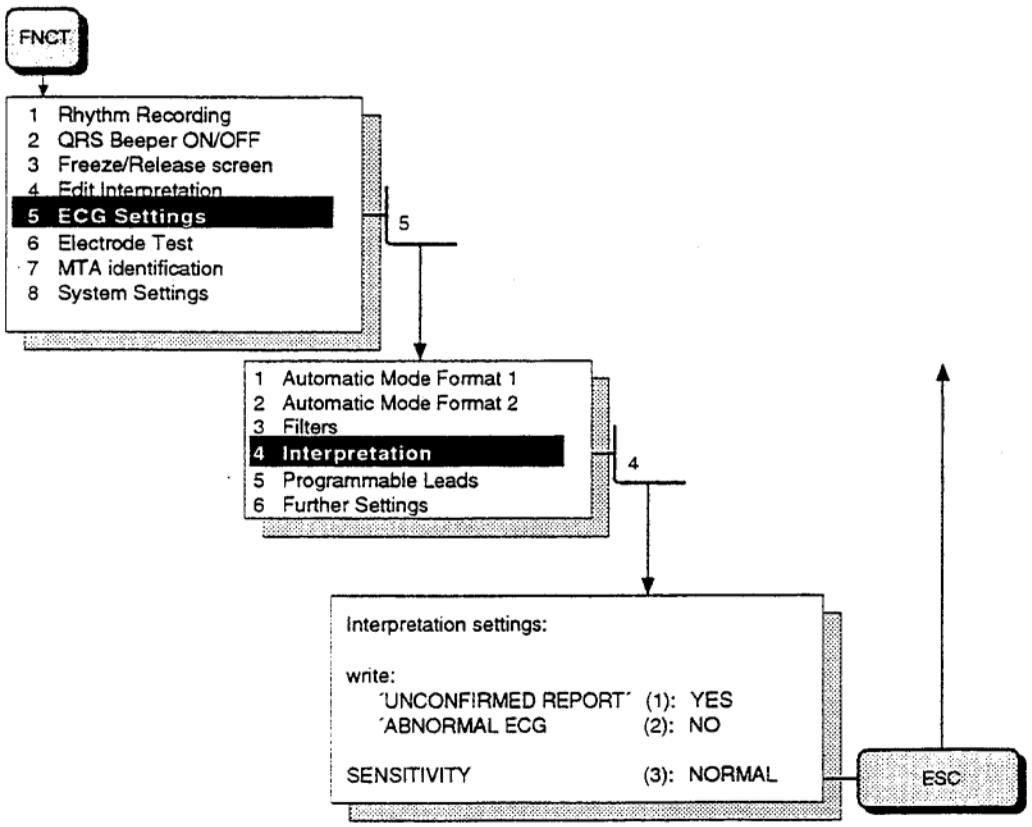
Print Interpretation Statements

Pressing key '6' prints the measurement table and interpretation statements (when set) at the end of the printout. This page can printed (YES) or omitted (NO). Note that the text page only prints the measurement table and the interpretation statement when these options are installed and enabled.

Suppressing Interpretation Statements

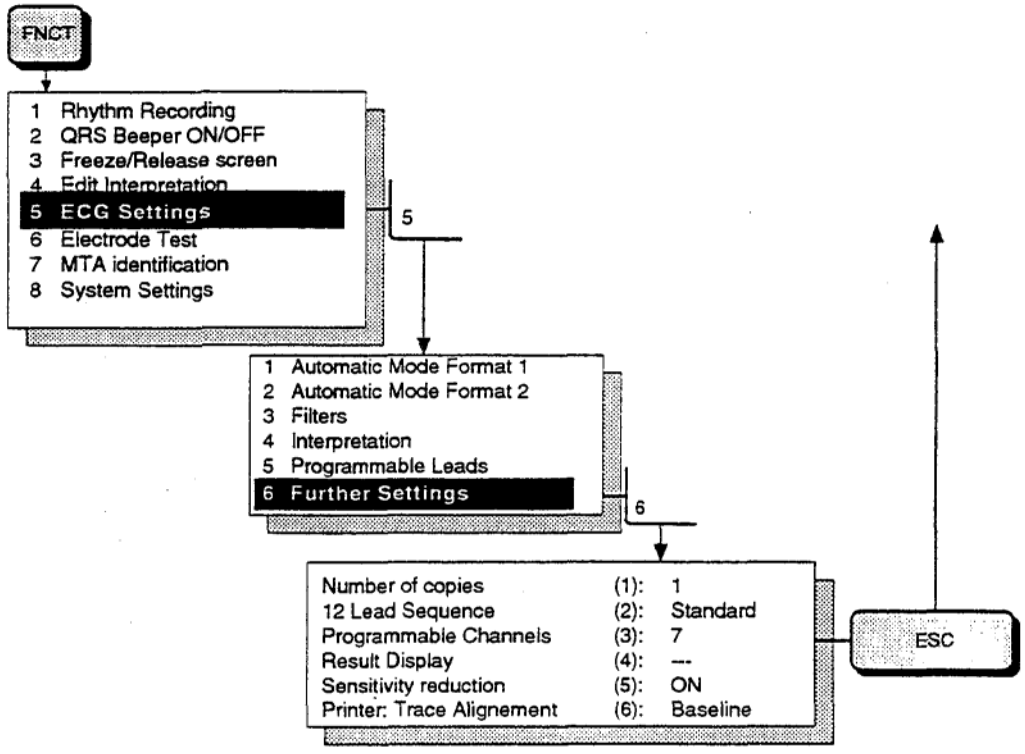
Note: Only when Interpretation (i) option is installed.

Statements "UNCONFIRMED REPORT" and "ABNORMAL ECG" may be distressing to the patient. These statements can be omitted. Additionally certain nonspecific ECG diagnosis can be suppressed. This may be advisable when carrying out ECGs for screening. For detailed patient analysis it is suggested that this is set as normal. To set these options enter the Interpretation menu as follows:



Define Number of Copies

To define the number of copies or to prevent the automatic printout, the following keys have to be pressed:



Press key '1' to select "Number of copies". If no printout is required select "0" here. Otherwise between "1" to "4" copies can be defined.

Display Average ECG Complexes

Note: Only when Interpretation (i) option is installed.

From the above menu option 'Result Display' sets this average ECG results. Pressing key '4' the average QRS cycles are displayed (Cycles) or omitted (——).

Trace Alignment

On the printout the ECG traces are aligned to the baseline. In the menu for further settings the alignment can be set so that the ECG traces do not overlap.

Press Key '6' to set the trace alignment either to **Baseline** (traces are aligned to the Baseline) or **Range** (traces are aligned in such a way that they do not overlap).

Automatic Mode Recording Procedure

To carry out an auto mode ECG proceed as follows:

1. **Switch the unit on and define the Automatic Mode format 1 and 2 as detailed in the previous paragraphs, if not already done.**
2. **Connect the patient cable as detailed in "Preliminaries".**
3. **Enter Patient Data as detailed in "Preliminaries".**
4. **Start the recording- Auto Format 1 press**

.

   - Auto Format 2 press

followed by

.

The message "ACQUIRING DATA" is displayed briefly in the information box on the display. This is followed by the message "PROCESSING ..." A printout with the ECG is given after a few seconds in the format defined.

The ECG data remains in the memory until it is overwritten by another recording or the unit is switched off. The data can be edited and printouts obtained all the time the ECG is stored. This is described in the following paragraphs.

Changing the Format / Obtaining Extra Printouts

Format 1

To obtain another printout of the last recorded and evaluated data in format 1, press COPY.

§ *When an ECG has been taken in auto mode, the format can be changed (and printout obtained) as many times as you like. Simply enter the Automatic mode format - (press the <FNCT> key and select 'ECG Settings'. Change whatever parameters you wish, press the <FNCT> key again). Pressing <COPY> gives the printout of the stored ECG in the changed format.*

§ *The sensitivity of the printout can be changed at any time using the mm/mV keys '8' to '-'.*

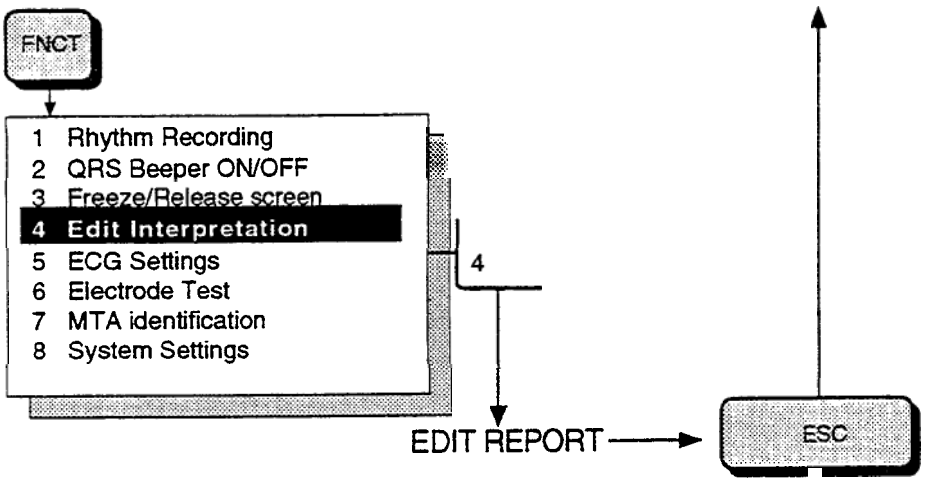
Format 2

To obtain another printout of the last recorded and evaluated data in format 2,

press 2ND followed by COPY.

Editing the Interpretation Report

Note: Only when Interpretation (C) option is installed.



Normal text Editing functions are used. Special editing functions are as follows:

¶	2ND followed by Right arrow key	moves the cursor to the beginning of the line
¶	2ND followed by Left arrow key	moves the cursor to the end of the line
¶	2ND followed by W	deletes the word where the cursor is positioned
¶	2ND followed by DELETE	deletes the line where the cursor is positioned

Display Average QRS Cycles or Interpretation Statements

Note: Only when Interpretation (C) option is installed.

When an ECG is stored pressing CHANGE SCREEN toggles the screen information as follows:

¶ Average QRS

¶ Interpretation Statement

¶ ECG trace currently being input

MANUAL MODE RECORDING

ECG acquisition commences as soon as the patient is connected and the ECG trace is displayed on the LCD. The lead display and recording parameters can be changed at any time as detailed in Chapter One. A printout of the ECG can be obtained at any time as follows:

Obtaining a Printout

Two methods are available:

1. **Press**

to obtain a printout of the screen content.

2. **Press**

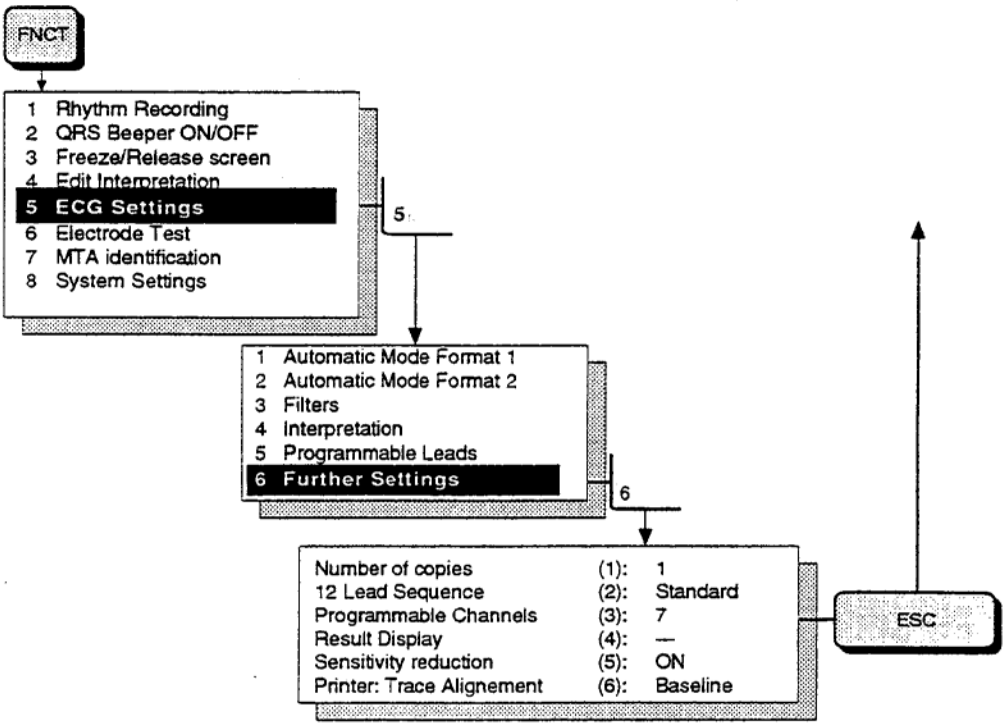
to obtain a continuous print out.

3. **The printout is continuous until the key**

is pressed.

Selecting Number of Channels for Manual Printing

The number of channels that can be printed are 3, 6 or a user defined number. Set the user defined number of channels as follows:



Press key '3' to set Programmable Channels.

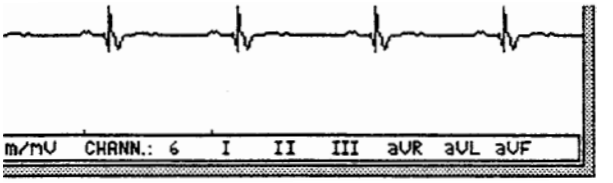
Before or during the printout the number of channels printed is changed by pressing PRINTER CHANNEL.

§ *During the printout the lead sequence can be changed with the* LEAD ◁ LEAD ▷ *keys.*

The leads that are printed are the standard leads followed by the user programmed leads (see table in Chapter 1).

For example when 3 leads are selected with the PRINTER CHANNEL *key, the* LEAD ▷ *key must be pressed 4 times to print all 12 leads (i.e. 4 prints each with three leads).*

The leads that will be, or are being printed are displayed on the bottom, right-hand side of the screen.

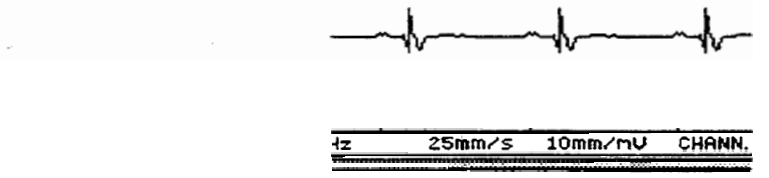


Select Printing Speed and Print Size

The printer speed is adjusted with the dual purpose keys '1' to '6' on the alphanumeric keyboard giving values of 2.5, 5, 10, 12.5, 25, or 50 mm/s.

The size of the printout (i.e. the height of the QRS complexes) is adjusted with the dual purpose keys '8' to '-' on the alphanumeric keyboard giving values of 2.5, 5, 10, or 20 mm/mV

The selected values are displayed on the lower part of the monitor and printout.



§ *The number of channels, speed and sensitivity can only be changed when there are no open menus or setup choices.*

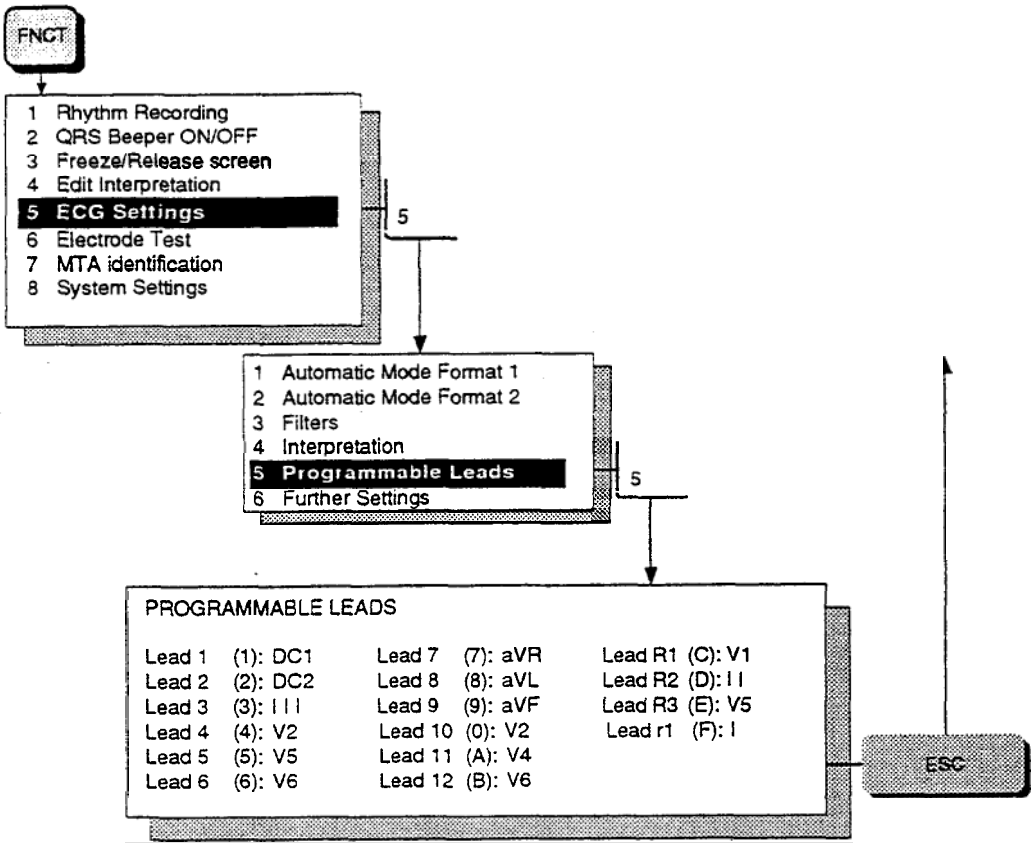
§ *These values can be set before or during printing.*

MANUAL RHYTHM RECORDING

Rhythm recording is the name given to "long term" ECG monitoring. The rhythm monitoring of ECG signals allows the constant recording of a specified lead for an unlimited length of time (limited only by the amount of paper).

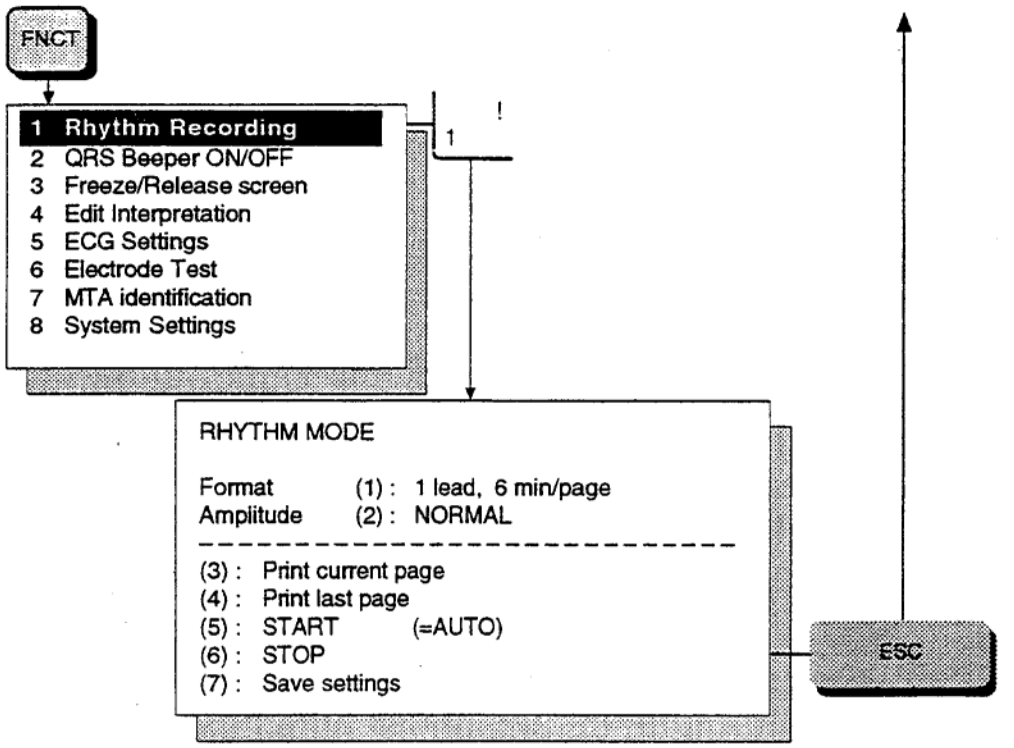
To carry out a Rhythm ECG proceed as follows:

1. **Switch the unit on and connect the patient cable as detailed previously.**
2. **Select the lead that you wish to monitor.**



R1 (Rhythm 1) is the lead that is monitored during Rhythm recording - Press key 'C' and then the '+' or '-' keys until the required lead is displayed.

3. Enter the Rhythm Mode Menu.



The menu gives the following selection:

¶	Format (1):	Select between:	60 sec/page 3 min/page 6 min/page 20 min/page
¶	Amplitude (2):	Select between:	NORMAL LOW (half amplitude)
¶	(3)	The current page is printed.	
¶	(4)	The last page is printed.	
¶	(5)	Start of the rhythm monitoring.	
¶	(6)	Stop the rhythm monitoring and printout with the actual time in hours and minutes.	
¶	(7)	Save selected setup.	

4. Set the Format and Amplitude and start the rhythm mode by pressing '5'.

"RHYTHM" is displayed in the information box on the display whilst the recording is in progress. A printout-out is given in the time set, i.e. every minute, every three minutes, six or twenty minutes.

5. Stop the rhythm mode at any time (in the Rhythm Menu) by pressing '6'.

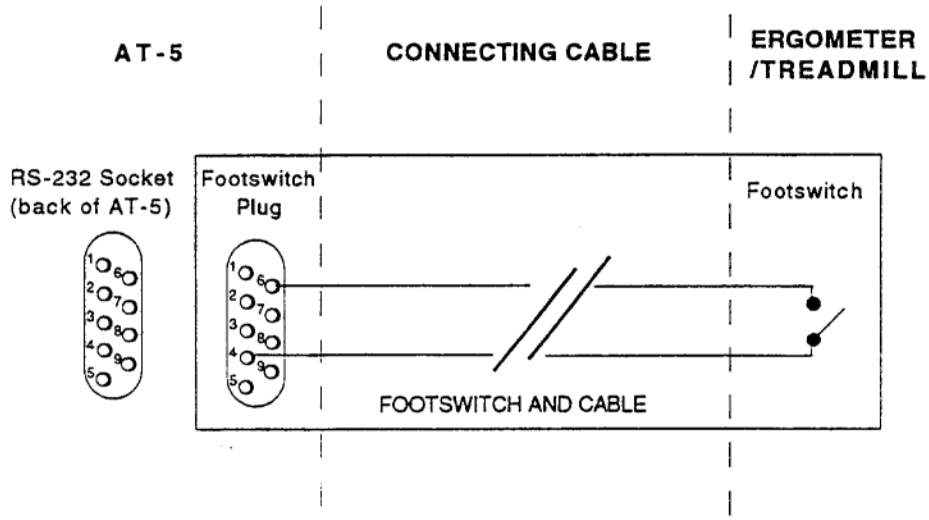
FOOTSWITCH OPERATION

Use the footswitch to initiate an AUTO MODE ECG in format 2. The footswitch must be connected to the RS-232 interface on the back of the unit. The footswitch when pressed shorts pins 4 and 6 of the RS-232 socket.

The footswitch must be set to ON in the Unit configuration menu. Press the FNCT key and select:

<<System settings> <Unit configuration>

See page 1. 22 for further details



CHAPTER 3

DATA STORAGE & TRANSMISSION

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INTRODUCTION

The SCHILLER AT-5 can store, send or receive ECGs to and from another unit in the SCHILLER family or to and from a computer (PC or Mainframe). The units can be connected directly or can communicate over a telephone line. Data transmission is facilitated via a standard RS-232 serial interface on the back panel.

Two methods of storage and transmission are available - automatic and manual.

- In manual mode the ECG in the memory is stored or transmitted when selected.
- In automatic mode the ECG is stored or transmitted automatically on completion of the recording.

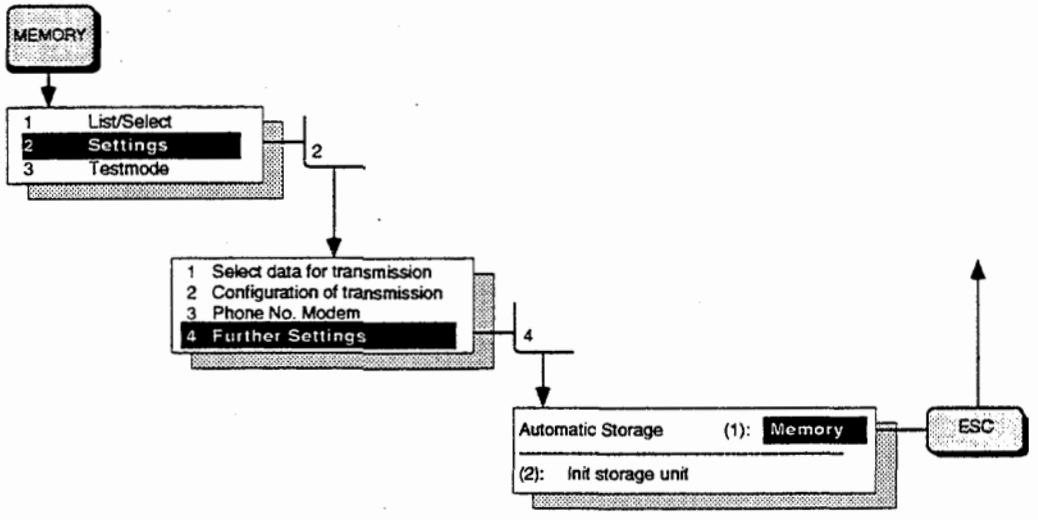
CAUTION - WHEN RECEIVING DATA FROM ANOTHER UNIT THE ECG IN THE MEMORY IS OVERWRITTEN WITH THE RECEIVED DATA!

CHAPTER 3

DATA STORAGE & TRANSMISSION

AUTOMATIC STORAGE OR TRANSMISSION

If an automatic storage or transmission of the recorded ECG is required, set the parameters as follows:



The 3 options are:

§ "Transmit" for automatic transmission.

§ "Memory" for automatic saving.

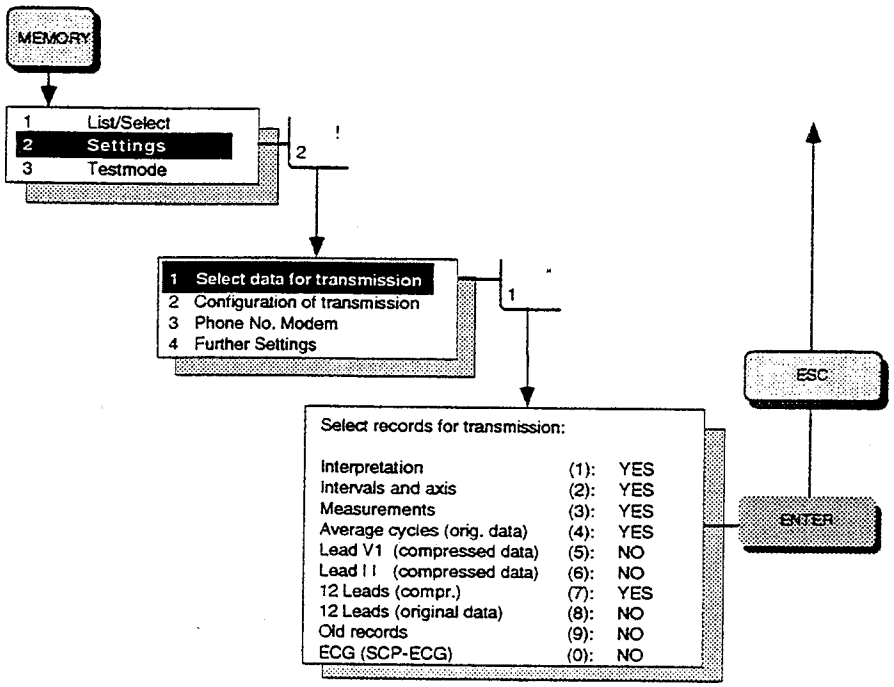
§ "NO" if the automatic mode is not required.

• Key **2** is a service tool only and has no function to the user.

NOTE: When transmitting, the setup must be defined as detailed in paragraph "Transmitting and Receiving Data".

Selecting Data for Automatic Storage & Transmission

The selection is the same for both automatic or manual storage / transmission. The options selected are independent of the format settings (e.g. Interpretation can be set to "YES" in the Format and set to "NO" here). This means that the interpretation is recorded and will be given on the printout but will not be stored / transmitted.



Select with the keys **1** to **9** and **0** the data that you wish to transmit or store.

§ *Selections 5 and 6 are the programmed Rhythm leads R1 and R2 respectively (see Chapter 1 - Programmable Leads).*

§ *When the '12 Leads (original data)' option is selected, only the original data is transmitted or stored and selections 1 to 7, 9 and 0 are suppressed.*

§ *When the 'Old records' option is selected, only the original SCHILLER format (raw data) is transmitted or stored. This selection should not be made when transmitting data to a computer.*

§ *"ECG (SCP-ECG)" stands for standard communication protocol. This protocol is used for data communication between electrocardiographs and PC-based data management systems or other ECG systems (SCHILLER units or others) where data can be stored. In order to communicate, however, both units must support this protocol type. When this option is set to YES, positions 1 and 3 are automatically set to YES. All other selections are suppressed.*

MANUAL STORAGE

To store an ECG proceed as follows:

Press

.

§ *If no ECG is in the RAM memory (i.e. an ECG recording has not been taken), an audible alarm will sound and the message "NO ECG IN MEMORY" will appear in the status field.*

§ *If all memory space is used, an audible alarm will sound and the message "MEMORY FULL" will appear.*

Check the list of recorded ECGs and delete a recording.

NOTE: This is the same process as when an ECG has been received from a remote unit.

TRANSMITTING & RECEIVING DATA

Direct data transmission/reception to a connected device is called LINE transmission and data transmission over a telephone line is called MODEM.

Two types of transmission formats can be selected in Line mode called RECORDS and BLOCKS. Record transmission is quicker and simpler. Block transmission is more secure as the transmitted data is checked for errors and corrected accordingly. *When transmitting or receiving to/from SEMA, BLOCKS must be used.*

Two types of transmission protocols can be selected in Modem mode called CCITT and BELL. These are standard modem protocols and are selected according to the type of telephone exchange (if in doubt contact your local PTT).

Other transmission settings that are applicable for both line and modem transmission are as follows:

Baud This sets the speed of transmission - the higher the Baud rate the quicker the transmission. In good quality lines or over short distances a high Baud rate can be set. When a lot of transmission errors occur, a lower Baud rate must be selected.

Parity This is a method of detecting errors in the transmission.

Stop This is a method that the hardware uses to determine the message.

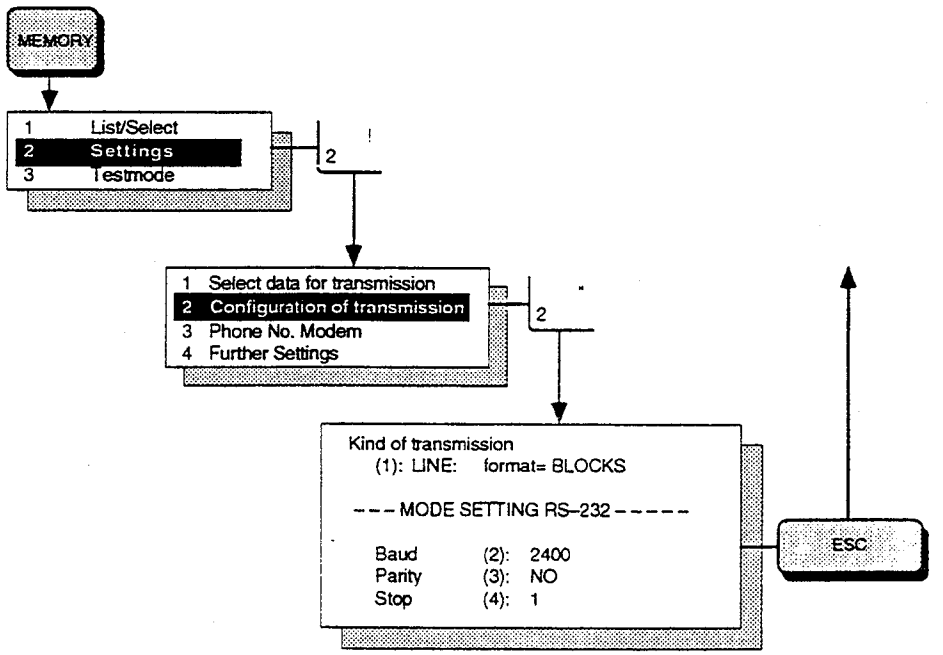
All of these settings are largely dependent on the device that is connected. THEY MUST BE THE SAME IN BOTH THE TRANSMITTING AND RECEIVING UNIT!

Transmitting a Recorded ECG to Another Device

To transmit the ECG stored currently in the memory, proceed as follows:

1. **Connect the RS-232 cable between the connector on the back panel of the AT-5 and the modem, computer or other SCHILLER unit**
2. **Set the transmission protocol.**

The following settings must be set before sending (*or receiving*) data to another device:



LINE/MODEM Key 1 selects Line or Modem transmission and the format and protocol for the selected mode. Two formats are selectable for modem transmissions as follows:

MODEM: Protocol = CCITT

MODEM: Protocol = BELL

Select in accordance to your telephone exchange.

LINE: Format = RECORDS

LINE: Format = BLOCKS

Record transmission is quicker and simpler. Block transmission is more secure as the transmitted data is checked for errors and corrected accordingly.

§ ***For the data transfer to SEMA only use BLOCKS.***

Baud (2) Use Key **2** to select the required Baud rate.

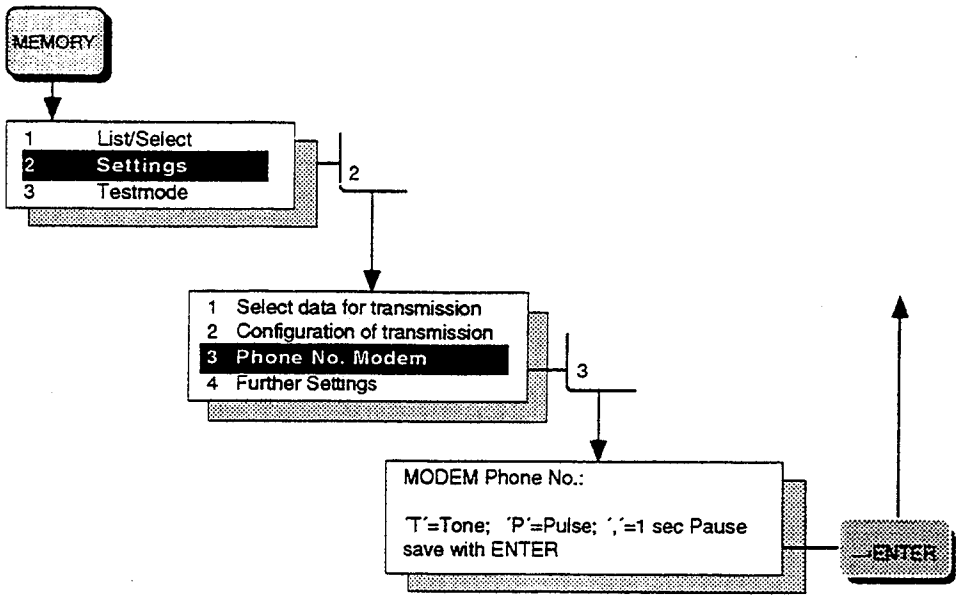
The following values are available:
75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 76800, 153600.

Parity (3) Key **3** selects the Parity.
The available choice is either EVEN, ODD or NO (Normal position NO).

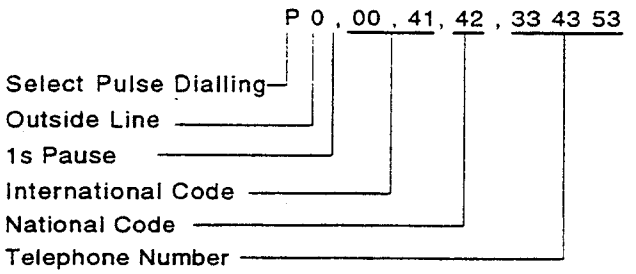
Stop (4) The length of the Stop bit is determined by pressing key **4**.
The available choice is either 1, 1.5 or 2 (Normal position 1).

§ *These settings must be the same in both devices.*

3. Set Phone Number (Modem transmission only).



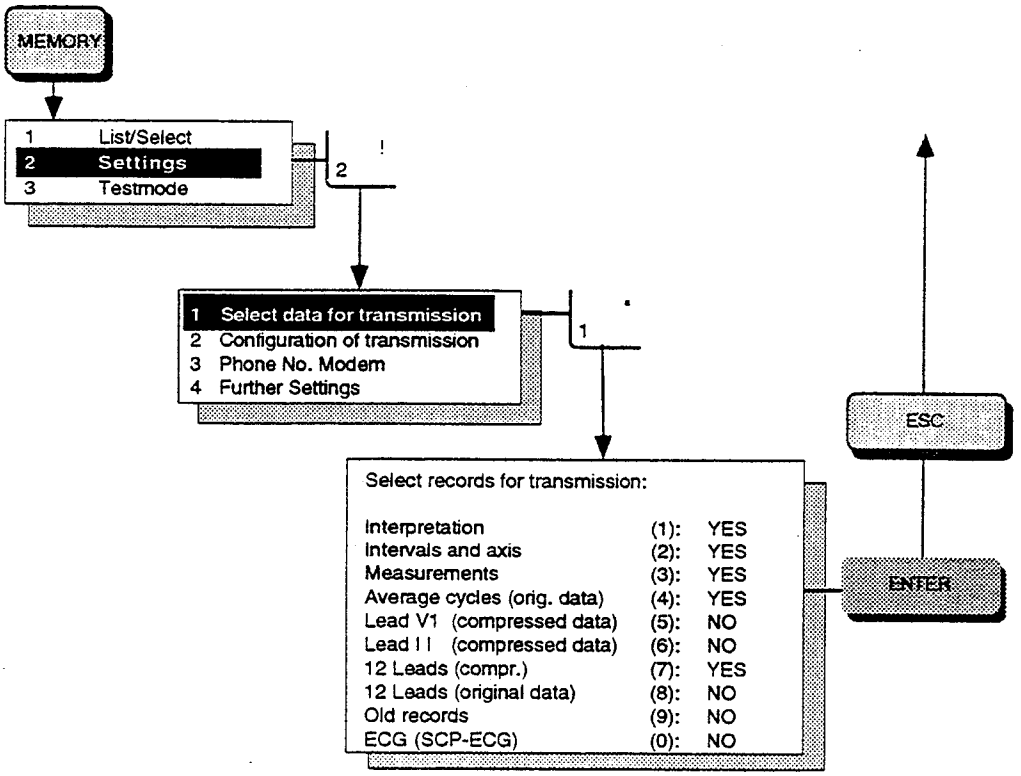
A typical example could be as follows:



§ *Before entering the telephone number the type of dialling must be entered. This is determined by the type of telephone exchange. All modern exchanges now use Tone dialling; older exchanges use Pulse dialling. If in doubt, select pulse.*

§ *If it is necessary to enter a pause in the dialling sequence then enter a comma. The comma gives a one second pause; if a longer pause is required, two or more commas can be entered. This may be required for example, if you have to wait for an outside line. To give the exchange time to set up the connection, it is also a good idea to insert a pause after a national or international code.*

4. Select Data for Transmission.



THE ABOVE EXAMPLE SHOWS THE TYPICAL SETTINGS THAT COULD BE USED FOR SENDING DATA TO SEMA.

With the keys **1** to **9** and **0** select the data that you wish to transmit. The options are send (YES) or not send (NO).

§ *Selections 5 and 6 are the programmed Rhythm leads R1 and R2 respectively (see Chapter 1 - Programmable Leads).*

§ *When the '12 Leads (original data)' option is selected, only the original data is transmitted and the selections 1 to 7, 9 and 0 are suppressed.*

§ *When the 'Old records' option is selected, only the original SCHILLER format (raw data) is transmitted. This selection should not be made when transmitting data to a computer.*

§ *"ECG (SCP-ECG)" stands for standard communication protocol. This protocol is used for data communication between electrocardiographs and PC-based data management systems or other ECG systems (SCHILLER units or others) where data can be stored. In order to communicate, however, both units must support this protocol type. When this option is set to YES, positions 1 and 3 are automatically set to YES. All other selections are suppressed.*

5. Press SEND DATA.

Data transmission is initiated. The message **"CONNECTING"** appears in the status field in the upper right of the screen followed by **"TRANSMITTING"**.

During transmission, numbers from 1 to 9 appear successively in the status field to indicate the progress of the transmission. Once the transmission is completed, there in an audible signal and the message **"ECG IS OUTPUT"** is given in the status field.

§ *If no ECG is in the memory, an audible alarm will sound and the message "NO ECG IN MEMORY" will appear in the status field.*

Manually Transmitting a Previously Stored ECG to Another Device

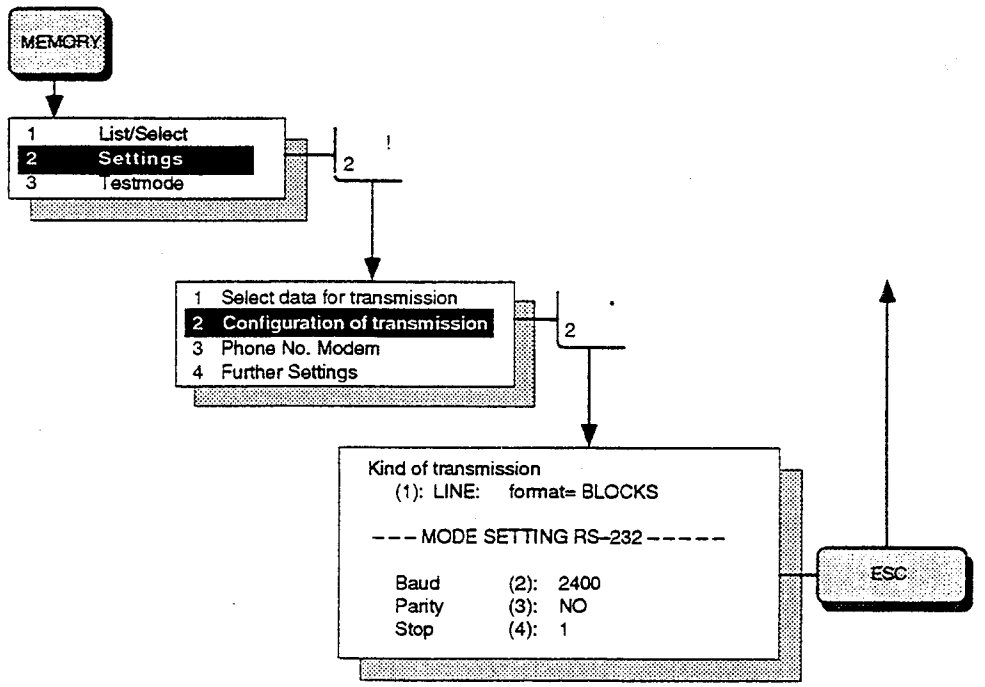
1. **Repeat steps 1 to 4 as with transmitting a recorded ECG.**
2. **Press** MEMORY.
3. **Select "List/Select" with key '1'.**
4. **Choose the record with the arrow keys.**
5. **Select "Transmit" with key '2'.**
6. **Start transmission with** ENTER.

Receiving an ECG from Another Device

To receive data from another device, proceed as follows:

1. Set transmission protocol.

The following settings must be set before receiving recorded data from another device.



The AT-5 must be set up to match the parameters of the sending unit as described previously.

2. Press RECEIVE DATA.

WARNING:
INCOMING ECG DATA WILL OVERWRITE ANY DATA WHICH IS CURRENTLY IN THE MEMORY!

The AT-5 is now in a permanent receive mode and waits for incoming data from the transmitting unit.

The message "WAITING FOR DATA" appears in the status field. When the incoming data is received, a printout of the ECG is initiated. The received ECG is now in the AT-5 memory and remains there until overwritten (by incoming ECG). To stop the received ECG being overwritten (by more incoming data) the receive mode must be quit.

3. **Quit Receive Mode by pressing** RECEIVE DATA **again.**

The following message appears on the display:

QUIT RECEIVE MODE?
(YES / NO)

Press YES + or NO - .

§ *The receive mode should be* quit as soon as the incoming data is received. AUTO MODE IS BLOCKED ALL THE TIME THAT THE UNIT IS IN RECEIVE MODE.

Store Received Record

To store the received record in the memory of the AT-5, proceed as follows:

Press STORE DATA .

ERROR MESSAGES

If transmission or reception cannot be carried out, an error message will be displayed in the status field.

A list of error messages and their possible causes is given below:

SERIAL LINK TIME-OUT

This indication appears if no signal is received from the remote unit (after approximately 30 seconds).

- ◊ Check that the remote unit is switched on and set to the correct parameters.
- ◊ Check the correct setup in both units (<MEMORY> key).
- ◊ Check that the connecting cable is plugged in correctly.
- ◊ Check the integrity of the cable assemblies (at both units).
- ◊ If using a modem, ensure that it is communicating with the remote modem.

RECEPTION ERROR (PARITY)

This indicates a parity error.

- ◊ Check that the parity is set correctly in both receiving and transmitting units (<MEMORY> key).
- ◊ If there is a parity error, it indicates that the data may be faulty. Select another ECG and re-transmit.
- ◊ Carry out the RS self test.

RECEPTION ERROR (OVERRUN)

This indicates a system timing error.

- ◊ Carry out the RS self test.

RECEPTION ERROR (FRAMING)

This indicates a transmission error or that the baud rate is not set the same in both units.

- ◊ Check that the baud rate is set correctly in both receiving and transmitting units (<MEMORY> key).
- ◊ Check that the connecting cable is plugged in correctly.
- ◊ Check the integrity of the cable assemblies (at both units).
- ◊ If using a modem, ensure that it is communicating with the remote modem.

TRANSMISSION ERROR	This is a general fault indication.
	◊ Check that the remote unit is switched on and set to the correct parameters.
	◊ Check that the connecting cable is plugged in correctly.
	◊ Check the integrity of the cable assemblies (at both units).
	◊ If using a modem, ensure that it is communicating with the remote modem.
NO ECG IN MEMORY	An ECG transmission has been attempted, but no ECG is stored in the units memory.
	◊ Store an ECG in the memory and attempt the transmission again.
	◊ If the same message appears, change the processor board.
MEMORY FULL	An ECG storage has been attempted, but no ECG can be stored in the units memory.
	◊ Check the list of recorded ECGs (<MEMORY> key) in the memory and delete unnecessary recordings.
NO PATIENT DATA	No patient data has been specified.
	◊ Type in the patient data (<PATIENT DATA> key).

TRANSMISSION CHECKS

See Chapter 4 - Maintenance and Trouble Shooting.

CHAPTER 4

MAINTENANCE AND TROUBLE SHOOTING

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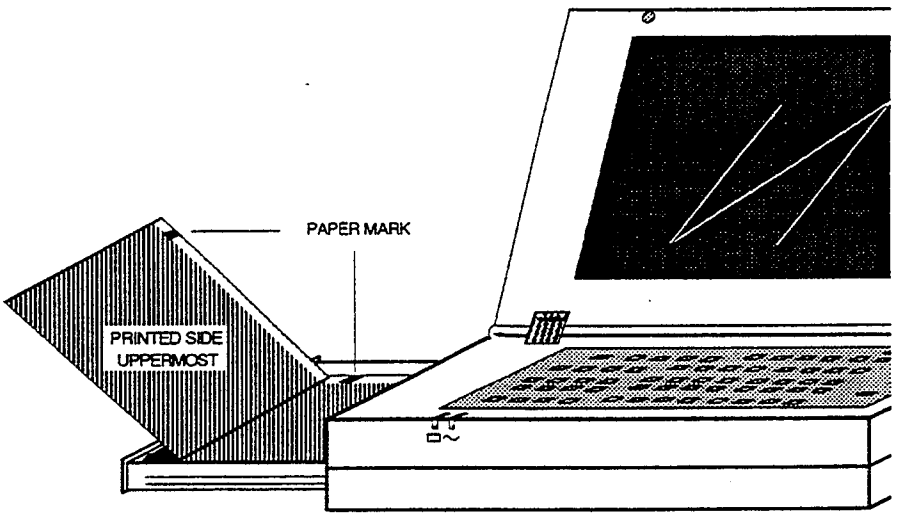
CHAPTER 4

MAINTENANCE AND TROUBLE SHOOTING

REPLACING THE RECORDING PAPER

A red strip on the bottom edge of the recording paper indicates that the paper is limited. When this strip appears, there are about ten pages left. We recommend that the paper be replaced as soon as this indication appears. Should the paper run out completely an audible alarm is initiated and the message "REFILL PAPER!" appears on the display.



To replace the paper, proceed as follows:

1. **Press** REPLACE PAPER.

The paper tray slides out automatically.

2. **Remove any remaining paper from the paper compartment.**
3. **Take a new pack of recording paper and place it into the paper compartment with the grid side upper most and the black paper mark at the top.**
4. **Pull the first sheet out of the paper tray so that it is over the roller.**
5. **Press** REPLACE PAPER.

The paper tray slides back automatically.

When printing is restarted, the warning message is removed from the display.

§ ***WELCH ALLYN can only guarantee impeccable printing quality if the original chart paper or paper of equal quality is used.***

Paper Handling

The thermal paper used in the AT-5 requires slightly different handling to normal paper as it can react with chemicals and to heat. However, when the following points are remembered, the paper will give reliable results:

The following points apply to both storage, and when archiving the results.

1. Before use, keep the paper in its original cardboard cover. Do not remove the cardboard cover until the paper is to be used.
2. Store in a cool, dark and dry area.
3. Do not store near chemicals e.g. sterilisation liquids.
4. In particular do not store in a plastic cover.
5. Certain glues can react with the paper - do not attach the printout onto a mounting sheet with glue.

CLEANING YOUR AT-5

CAUTION:
SWITCH THE UNIT OFF BEFORE CLEANING AND DISCONNECT THE MAINS. DO NOT, UNDER ANY CIRCUMSTANCES, IMMERSE THE APPARATUS INTO A CLEANING LIQUID OR STERILIZE WITH HOT WATER, STEAM, OR AIR.

Cleaning the Casing

The casing of the AT-5 can be cleaned with a soft damp cloth on the surface only. Where necessary a domestic non-caustic cleaner can be used for grease and finger marks.

Cleaning the Patient Cable

The patient cable should not be exposed to excessive mechanical stress. Whenever disconnecting the leads, hold the plugs and not the cables. Store the leads in such a way as to prevent anyone stumbling over them or any damage being caused by the wheels of instrument trolleys.

The cable can be wiped with soapy water. Sterilization, if required, should be done with gas only and not with steam. To disinfect, **wipe** the cable with hospital standard disinfectant.

The electrodes can be cleaned after every use with soapy water. Make sure that no water is left in the suction cup of the suction electrodes. Sterilization can also be performed with gas or with Alhydex or Vygon.

PLANNED MAINTENANCE

The AT-5 has been designed to be trouble-free throughout its life and does not require any regular maintenance. However, in common with all medical equipment, it is recommended that a safety check be carried out once a year. The extent of the check is detailed below.

Technical Safety Check

The unit should undergo a technical safety check at 12 monthly intervals.

The following checks must be performed and documented:

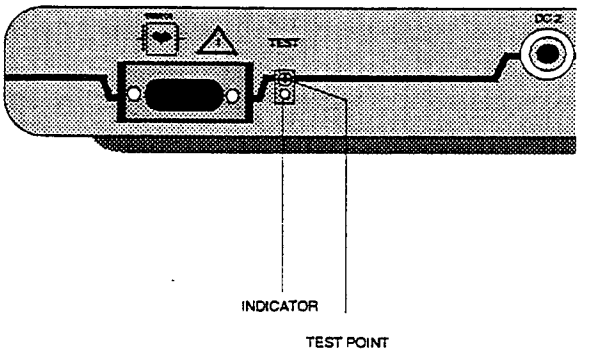
1. **Visual check of the unit and patient cable.**
2. **Tests according to IEC 601-1 and IEC 601-2-25.**
3. **Functional tests according to AT-5 Service Handbook.**

BUILT-IN TESTS THAT CAN BE PERFORMED BY THE USER

Each time the unit is switched on, the AT-5 performs a self check of all major functional areas. This ensures that the unit is functioning correctly and provides a degree of integrity in all ECGs carried out. If an error is detected during this self-test operation of the unit is inhibited - call an authorised WELCH ALLYN dealer. Certain other tests are detailed below to check the patient cable and to check the integrity of the transmission circuits and cable.

Testing the Patient Cable

The electrode leads can be tested by means of the test socket located on the Input / Output panel on the right-hand side of the unit.



1. **Use the special coupling that is delivered as accessory with the unit and connect with the electrode plug.**

Test socket AT-5 <- <- Electrode plug

2. **Ensure that the AT-5 is switched on and the patient cable plugged in. Now insert the electrode plug into the test socket.**

The test indicator should light indicating that the lead is satisfactory. Repeat the test for all leads.

Tests after Defibrillation

Check patient cable with cable tester.

Testing the Transmission Channels

The test transmission / test reception options enables a test sequence to be generated and received. Use these test options to ensure that the receiving and transmitting units can communicate and that the cable assemblies, connectors etc. between the communicating units are good.

The test message generated is a string of all ASCII characters - ABED.... 1234....abcd... etc. When the test transmission / reception option is selected, the string of characters sent by the transmitting unit are displayed on the LCD in the receiving unit. In the transmitting and receiving units a message is displayed indicating that a test transmission is in progress.

To carry out this check proceed as follows:

1. **Ensure that the cable link between the two communicating units is present.**

2. **Switch both units on. In the transmitting AT-5 press** MEMORY.

3 **Select Test Mode followed by Test output and ensure that the following message is displayed at the bottom of the screen:**

TEXT OUTPUT

If transmitting to another AT-5:

a. Press MEMORY.

b. Select **Test Mode** followed by **Test input.**

If transmitting to a computer or any other unit ensure that it is in receive mode.

4. **Ensure that a series of characters are displayed on the receiving unit.**

5. **Repeat the procedure in the opposite direction.**

§ ***The Baud rate, parity setting and stop bit setting must be the same in both the transmitting and the receiving units.*** *The Baud rate can be changed with the '+' and '-' keys, the parity setting with the 'P' key and the stop bit set with the 'S' key.*

§ *The test input/output is stopped by pressing key <Q> (End of test input/output).*

NOTE: The self test with test plug option in this menu is carried out with the special test plug and is intended for use by authorised service personnel only.

TROUBLE SHOOTING

Electrical Interferences

Thanks to digital transmission of the ECG signals the influences of electrical interferences and artefacts are reduced to a minimum.

Disturbances in the mains supply are suppressed by a mains filter (adaptive digital filter) without influencing the ECG signals.

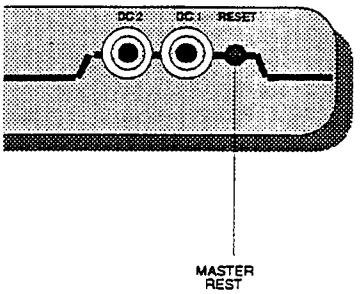
To avoid electrical interferences, check when using the unit that it is set up in proper distance to any interference source. It should not be placed near X-ray or diathermy units, strong lamps, large transformers or motors.

Master Reset

In exceptional circumstances the unit can 'lockup'. None of the keys respond and the screen is frozen. When this happens the master reset key must be used. ALL STORED DATA IS LOST.

§ ***Your unit should only lockup rarely, if at all. If the unit is locking up often, consult your local WELCH ALLYN dealer or contact the WELCH ALLYN service department.***

Press the red reset button with a sharp instrument.



Fault Diagnosis Chart

FAULT DIAGNOSIS TABLE	
Indication	**What to Check**
Unit does not switch On	Green mains indicator on? No? - check mains supply. Yes ? - check the screen contrast by pressing the CONT - and CONT+ keys. If the mains is OK and the screen is still not lit, press the Master Rest button on the side of the unit with a pointed instrument. Wait a few seconds and switch on again. If the screen is still not lit call your local WELCH ALLYNdealer.
QRS traces overlap	Ensure that the automatic senitivity reduction is not switched off (<FNCT> <ECGSettings> <Further Settings>. Baseline Drift - check electrode contact . Press baseline reset key.
`Noisey` traces	CHECK ELECTRODE CONTACT - RE-APPLY ELECTRODES. Ensure that the patient is relaxed and warm. Check all filter settings (<FNCT> key, 'ECG settings', 'Filters'). Activate myogram filter. Ensure mains filter is correct for mains supply.
No Printout obtained after an Auto test	Press <FNCT> key and select 'ECG Settings' followed by 'Further Settings'. Ensure that 'Number of Copies' is not set to '0'. Press <FNCT> key and select 'ECG Settings' followed by 'Automatic Mode Format'. Ensure that a ECG lead option is selected and that at least one option is enabled. Press <MAN START>: if the printer still does not function call your local WELCH ALLYN dealer.
Printout fades or is not clear	Ensure that fresh WELCH ALLYN paper is installed. Note that the thermal paper used in the AT-5 is heat (and light) sensitive. If it is not stored in its original seal, stored in high tempertures or is simply old, print quality can deteriorate. Ensure that the paper has been installed correctly with the paper mark at the top. If the problem persists call your local WELCH ALLYN dealer.
No printout of interpretation statements or measurements	Check that the interpretation and measurments options are enabled and that the text page is enabled (<FNCT> 'ECG Settings' 'Auto Mode Format').
No printout or display of average ECG measurments	Ensure that the interpretation and measurments options are enabled and that the text page is enabled (<FNCT> 'ECG Settings' 'Auto Mode Format'). Check that 'Result Display' is set to 'cycles' (<FNCT> 'ECG Settings' 'Further Settings')
No Key response, LCD locked	Press the Master Reset button

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